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JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE,

Civil Engineering, the Arts and Manufactures,

AND THE RECORDING OF

AMERICAN AND OTHER PATENT INVENTIONS.

EDITED BY

PROF. JOHN F. FRAZER,

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JULY, 1859.

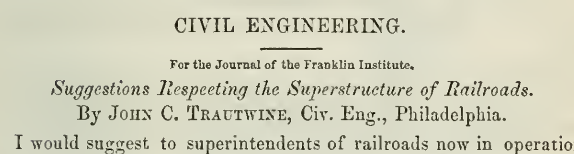
CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Suggestions Respecting the Superstructure of Railroads.

By JOHN C. TRAUTWINE, Civ. Eng., Philadelphia.

I would suggest to superintendents of railroads now in operation, the trial of a few rods in length of superstructure with string-pieces, and two sets of cross-ties, as shown by the following sketch. The bottom of the string-piece is supposed to be elevated about an inch above the ballast. It appears to me, that the elasticity insured to the rail *throughout its entire length* by this arrangement, will be found to diminish to a very great extent the destructive *pounding* action which the engines exert upon the rails of all the superstructures now in use. Experience would soon point out the proper dimensions and distances apart of the timbers to be employed for engines of any given weight, in order



to insure the requisite degree of elasticity, which evidently admits of being varied to any extent which may be found desirable. The increased quantity of timber involved in this proposed plan is a manifest objection to it; but experience only, can indicate whether the attend-

ant advantages which it possesses, may not more than counterbalance this objection, together with any others to which it may be liable. Beside the greater presumed durability of the rail, *from the fact that no portion of it rests on a rigid support;* we should secure a much more efficient rail-joint; inasmuch as the joints would rest *upon* the upper cross-ties, instead of *between* the ties, as is the present preferred practice; thus combining increased strength of joint, with greater uniformity of elasticity. We also should elevate the rail more beyond the influence of snow. Moreover, should this expedient enable us to obtain that certain (uncertain?) amount of elasticity of rail which all engineers concede to be so important a desideratum, it will doubtless lead to the adoption of more efficient supports for the lower cross-ties themselves;—supports which may extend below the influence of rain and frost; and thus effect a very important reduction of expense for rectification of the track,—beside dispensing with the use of ballast.

The great objection to the employment of such supports hitherto, has been the increased *rigidity of track* attendant on them, and by which the destruction of the rail is greatly accelerated. But if we can devise a means of modifying or entirely annulling this rigidity *in the rail*, by a process *entirely independent of the foundation on which the rail rests*, then this objection vanishes; and the way seems to open for arriving at a much more perfect superstructure than has hitherto been used.

I hope that the subject may be regarded by some of our intelligent superintendents as being of sufficient interest to induce them to make a trial of it, if only for a few lengths of rail; and to communicate the result through your valuable Journal.

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*Substitute for Feed Pumps and Donkey Engines.**

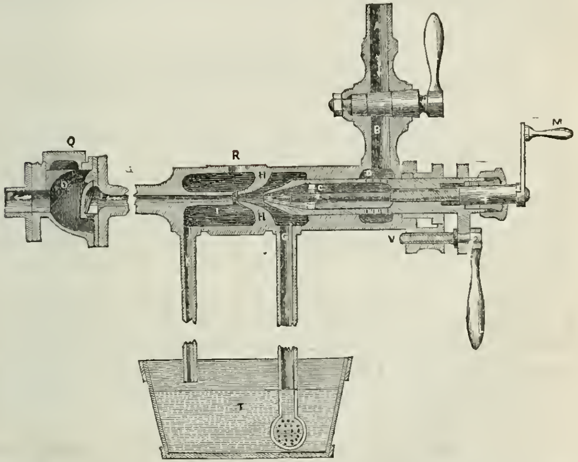
A very curious apparatus, called an *Automatic Injector*, invented by M. H. Giffard, and made by M. H. Flaud, the well-known engineer of Paris, has recently attracted considerable attention amongst scientific and practical men in France. The apparatus has been adopted by the Director General of Naval Construction in France; and has already been ordered by more than one well-known firm in the north of England.

The object of the apparatus is to supply water to the boilers of steam engines, or other steam apparatus, by means of the force of the steam contained in the boiler alone, and to return to the boiler all, or very nearly all of the heat contained originally in the steam thus used as the motor for supplying water to the boiler. It works without any aid from machinery; it is, in fact, perfectly automatic, as the title implies, and, consequently, it acts equally well when the steamboat, locomotive, or engine to which it is attached, is in motion, or at rest.

A B is the pipe bringing steam from the boiler; C D another pipe or chamber which receives the steam from the former through the holes at D—this latter pipe terminates conically; E F, small piston or rod

* From the Lond. Mechanics' Mag., April, 1859.

working by means of a screw or handle, F M; this serves to regulate or prevent entirely the passage of the steam; G is a suction water pipe. The water is drawn up into the chamber which surrounds the conical end of the steam pipe C D, and passes through the opening marked by an arrow between H H. The space left for the exit of the water is regulated by means of the lever and screw L, which moves the steam pipe, or chamber, C D, in either direction; I J, is a passage to carry the water to the boiler, together with the steam which communicates to the water a portion of the force with which it is charged by the pressure in the boiler; O is a valve to prevent the return of the water from the boiler when the apparatus is out of work; P leads directly to the boiler; Q is a screw stopper, to allow of re-adjustment or cleansing of the valve; K is a tube which carries off any superabundant water which may collect in the space around; I R is an opening with a sliding corner, through which the action of the apparatus may be distinctly seen; the steam and water combined forming a continual and rapid stream between the parts H and I.



To work the apparatus—the diameter of the water supply pipe being calculated to give the necessary amount of water—the rod E F is moved forward by the handle M, until the conical end of the rod stops the orifice of the cone. The steam cock in the pipe A B is then turned on; the screw handle M is then turned back a turn or so, to permit a small quantity of steam to pass. The steam in its rapid passage creates a vacuum in the chambers of the apparatus, and the water rushes up the pipe G into the space above. As soon as the water has entered, the handle is turned round so as to draw back the conical rod, and permit

free passage to the steam: the water is then carried rapidly into the boiler, and ceases to run off by the discharge pipe K.

The principle upon which the apparatus is based is, that as the pressure is equal upon all the interior surface of a steam boiler, and consequently as each unit of surface sustains the same pressure, if the steam is taken from the boiler into the apparatus by a larger orifice than that through which it is returned, the force of entry of the steam will be in greater proportion to the dimensions of the two orifices; or, in other words, steam brought from a boiler through a pipe of a given diameter, can easily be forced into the boiler again through the other end of the pipe, provided it have a much smaller aperture. In the machine in question, the entering orifice bears but a very small proportion to that of the supply pipe, because it is necessary to allow for the loss of force occasioned by the action of the water upon the steam.

In the above cut the apparatus is represented in a horizontal disposition, whereas it is now made vertical, but the only difference in the arrangement of the parts is the curving downwards of the two water-pipes G and K.

For the Journal of the Franklin Institute.

Mechanical Expansion Table. By JAMES H. WARNER, Engineer Corps, U. S. N.

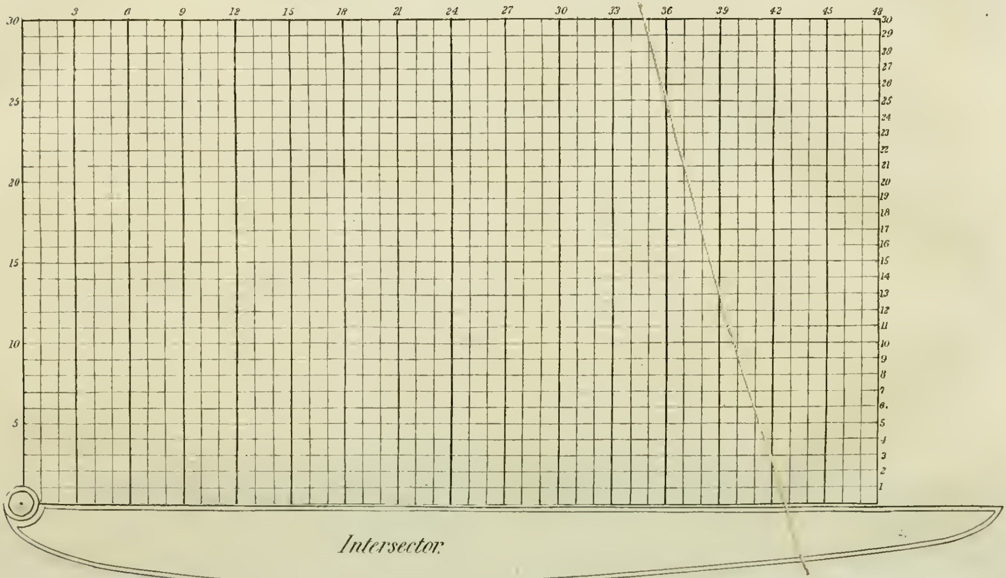
The expansive properties of steam have become so familiar to engineers generally, that to present an example bearing upon the subject may appear somewhat presumptuous. But the following is simply a *mechanical* method of doing that which is, perhaps, better done with figures. This table (Plate I,) is based upon Marriotte's law of expansion:—that the pressure decreases in an inverse ratio with the distance to which the steam is expanded, and of which it is a linear exemplification.

The dimensions of figure may be considered those of a steam cylinder, the vertical lines forming divisions of length, the horizontal lines indicating pressures of steam. These divisions are equal in the diagram, but the divisions of length are not required to be the same as the vertical, or those representing pressures of steam; and although limited in the Plate to 48 inches, and 30 pounds per square inch, may be carried in either direction to any desirable extent.

In explanation, let the pressure of steam be 30 pounds, cut off at 24 inches, and expanded to 48 inches, to find pressure at end of stroke. Bring the edge of the *intersector* to the junction of the vertical line corresponding to the distance to which the steam is expanded, and the *pressure line* 30. Then the point where the intersector cuts the vertical or *cut-off line* 24, indicates the pressure of steam expanded to 48 inches equal 15 pounds. The conditions being the same to find pressure at 36 inches, bring the intersector to the lines 30 and 36, representing pressure and distance. Upon the cut off line we find 20 pounds, the required pressure.

Suppose the pressure of steam equal 25 pounds, cut off at 8 inches,

MECHANICAL EXPANSION TABLE.



and expanded to 45 inches, bring the intersector to junction of pressure line 25, and distance line 45, we find upon the cut off line 8, the pressure 4, 4 pounds. The same pressure is required for any other pressure and distance. The intersector operating upon the *given* pressure line, for any distance throughout the length, the *required* pressure will be indicated upon the cut off line.

This table constructed upon a larger scale will admit of decimal and other subdivisions, giving the pressure sufficiently correct for practical purposes.

The pressures as noted upon the cut off line are the ordinates to a hyperbolic curve corresponding to that degree of expansion.

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*Ye Anatomie of ye Engineere.**

The *Indian Punch* has the following:—Although an arch man, yet is he never forgetful of gravity; and though he damneth and blasteth more than any other man, he piqueth himself on being always correct in his terms: he is a dab at algebra, for which a Y Z is needful: he is a very Noah at describing arcs. Though he seeketh not after taverns he is conversant with sines, and payeth due attention to his cosines and sick Aunts. Even though not wealthy, he helpeth to establish many a bank. He, ever kind and hospitable, supplieth chairs for sleepers, and though addicted to rail is never forgetful of the tender: he is a dutiful subject and though often in hot water, ever payeth fit attention to the Governor. He is somewhat of an ornithologist, knoweth all about cranes and crows, kites, tumblers, and cocks for hengines, and moreover maketh wire ducks to aid his resonant steam eagles to fly. He is also somewhat of an entomologist, understanding flies, crabs, worms, and such likes, and not above taking notice even of a cows ticks. Though partial to hydraulics he is not otherwise a rollicking man, yet is at home in high dressed attics, where he often maketh use of new mattocks in his area speculations. He is a peaceful man, though well versed in triggernometry, and in the habit of making great use of switches in various ways. He is of levelling tendencies, yet sometimes wisheth he were monarch of all he surveyed. He is the most progressive of mortals, axing his way through forests and picking it through rocks, and, paradoxical as it may seem, he opens a country by putting locks on the rivers and keys on the banks. He is by no means a hater o' docks man, but well versed in dry dock trinal subjects, and would never desire to pull down the church unless it stood in the way of a railroad. He reverenceth the institutions of his country, because in them he recognizeth the mechanical powers. The Press he rightly regardeth as the lever; the ten-pound voters as the small end of the wedge; the House of Lords as the inclined plane, and the Commons as the screw: the Army he conceiveth to be both hammer and tongs combined, the Navy a series of pulleys, and country justices in general pumps. His affection for the oonstitution is unbounded, for he only regards it in the light of the common wheel.

* From the London Builder, No. 846.

*On the Burning of Welsh Steam Coal in Locomotive Engines.**

By J. Tomlinson.

[Read at the Institution of Mechanical Engineers.]

The use of coal in locomotive engines having become almost the rule, the writer offers the following results of a series of trials he has made with the steam coals of South Wales, in locomotive engines upon the Taff Vale Railway, in comparison with the best descriptions of coke to be had in the same district; as there has hitherto been a difficulty in the use of that description of coal for such a purpose almost amounting to prohibition, from the fact that in all previous trials a failure has resulted from the burning of the firebars. This failure of the Welsh steam coal in locomotive engines has been hitherto attributed to the firebars becoming clinkered over; but the results of the trials described in the following paper appear to show that the failure has arisen from an entirely different cause, and one that can be completely obviated.

The writer was originally driven to the use of coal alone for carrying on the traffic of the Taff Vale Railway in January, 1858, in consequence of the continued strike of the colliers in the Rhondda Valley, where the coking coal is obtained. Previous to that time little or no coal had been used in locomotives, owing to the good quality and low price of the coke; and from the idea that coal could not economically compete with coke for the heavy work of this line, and also from the known difficulties to be overcome in its employment. The transition from coal to coke being sudden and unprepared for, it became necessary to watch the matter closely, so as to determine which of the various descriptions of coal would answer the purpose best, and to arrange its treatment; more especially as at the outset, from the various qualities of coal that had to be used, the firebars were continually being burnt out, and seldom could be made to last two days without passing through the hands of a smith to be separated and straightened; even then several bars a day were totally destroyed in each engine, some engines having had two entire new sets a day to run 100 miles. After careful consideration of the subject it was decided to use only one description of coal; the preference was then given to the steam coal over the bituminous, as being more pure in its composition, and smokeless; and after attentive observation and trials the Aberdare Four Feet Vein coal was chosen. With this coal it was found that the least damage was done to the firebars, and the best result obtained by working the engine with a very thin fire, say not exceeding 9 inches with a moderate load, and slightly thicker as the load increased, not however exceeding 15 inches in any case. In working with a light train or down hill with a loaded train, it was found advantageous to keep even a more shallow fire than 9 inches; for the blast being very light (as little or no traction is required down hill on this railway), the supply of steam could not be kept up unless the air were admitted with little difficulty; it is however necessary to be prepared in case of being stopped, and

* From the Lond. Civ. Eng. and Arch. Jour., May, 1859.

therefore a bright fire was a desideratum which could not be obtained unless it were kept thin.

The injury to the firebars was however still a great item, notwithstanding all the care that could be bestowed on them; for it is difficult to get a number of men to attend implicitly to rules which give them more trouble than they have previously been accustomed to. The writer therefore was induced to try an experiment by covering up the entire surface of the bars with small pieces of firebrick, not exceeding 3 ins. cube, and putting the fire on them, so as to prevent the direct action of the fire on the iron of the bars; and it was found that from the clean nature of the coal no bad result took place in the generation of steam, while the bars now received little or no injury. This plan has consequently been generally adopted, but with the partial substitution of clinker from stationary engines instead of firebrick alone. It has completely obviated the difficulty of the bars being burnt, and a set of bars will now last on an average four months, running about 100 miles a day. It is also attended with a beneficial result; for the small coal, instead of passing directly into the ashpan unconsumed; adheres partially to the red-hot brick and clinker, and is consumed; and notwithstanding that the Welsh steam coal falls readily to small, and has little if any binding property, the engines can run 100 miles without cleaning out the ashpan. Another description of coal containing a larger percentage of ash has also been tried for getting up steam and making the first fire to start with, which clinkering slightly on the bars most effectually protected them from burning: the use of this coal was however limited to 5 cwt. per day for each engine.

To place the engine more out of the control of the men, the plan was adopted which had been in use on other engines, of perforating the shield of the firedoor and drilling five or six two inch holes in the door itself, so as to admit a little air above the fire; this was found useful not only in assisting combustion, but also in preventing the blast from lifting the small particles of coal and thereby choking the tubes.

Having so far succeeded in efficiently working the traffic entirely with coal, and finding the engines were working the trains with a smaller weight of fuel than they had previously done, the writer was disinclined to return to coke without good reason, after the experience he had had. A series of experiments was therefore made to test the commercial value of each description of fuel. The first series of experiments was made with an engine working the regular mineral trains, with Aberdare Four Feet coal and Rhondda Valley best coke: the second series, with the same coal and coke, with a special train of thirty-five loaded coal wagons weighing 269 tons, run at the regular speeds of the ordinary trains of about $11\frac{1}{2}$ miles per hour: the third series, with various fuels, with a special train of forty loaded coal wagons weighing 314 tons, run at a speed of twenty miles per hour up the hill and twelve miles down (twelve miles per hour being the limit down hill with loaded trains): and the fourth series, with bastard steam coal and Aberdare Nine Feet coal: the former of these has a larger percentage of ash and more bituminous property, the only objection

to its use being the smoke: it does not burn the bars, and is fully as economical as the pure steam coal.

The whole series of experiments were made with the same engine and by the same engineman. The engine is of the following dimensions: cylinders 16 inches diameter and 24 inches stroke; six wheels coupled, 4 ft. 6 ins. diameter; firebox 3 ft. 6 ins. square by 4 ft. 10 ins. high; 156 tubes, 13 ft. 3 ins. long by 2 inches diameter, and No. 11 to No. 14 wire gauge thickness; safety valves loaded to a pressure of 110 lbs. per square inch.

The following table gives the general results of the whole of the experiments, showing the quantity of fuel consumed per ton per mile, the quantity of water evaporated per pound of fuel, and the average speed of the train during running:—

Description of Fuel.	Fuel consumed per ton per mile.	Water evaporated per pound of fuel.	Speed in running miles per hour.
	lb.	lbs.	miles.
Coal—Aberdare Four Feet Vein, .	·127	7·63	11·5
Coke—Rhondda Valley Best Coke,	·172	7·62	11·5
Coal—Aberdare Four Feet Vein, .	·130	8 37	11·5
Coke—Rhondda Valley Best Coke,	·124	8·34	11·3
Coke—Rhondda Valley Best Coke,	·136	7·54	16·8
Coal—Aberdare Four Feet Vein, lump,	·133	7·73	16 5
Coal— " half lump and half small,	·153	7·11	14·8
Coal—Rhondda Valley Bastard Steam Coal	·110	8·63	11·5
Coal—Aberdare Nine Feet Vein, .	·112	8·15	11·5

The results in the consumption of fuel showing in all cases slightly in favor of the coal, they may fairly be considered equal; and as the abuse of the engine when burning coal is more easily detected than when using coke, this forms a further advantage in favor of coal. The preference may also be given to coal over coke for the freedom in generating steam, which will allow the blast pipe to be of larger dimensions than when burning coke. This has been clearly shown, as the engines are now maintaining steam at 100 to 110 lbs. per square inch with coal, with the same sized blast pipes as were used previously for 80 lbs. with coke; and the firebars have also been placed closer together, the air spaces being reduced from 1 inch to $\frac{5}{8}$-inch. Hence the writer thinks it may be concluded that the Welsh smokeless coal may be economically used in substitution for coke; and that where failures have taken place previously, they are to be attributed to the very great heating power of the coal; and that the difficulty with firebars has resulted not from clinker, but from the absence of a proper protection for the iron of the bars, so that with heavy firing the heat has struck downwards and fused the bars themselves.

Nearly all the engines on the Taff Vale Railway are now burning Welsh steam coal entirely; they take with each train a load of eighty empty wagons averaging $3\frac{1}{4}$ tons each or 260 tons total, up an average rising gradient of 1 in 309, at from 13 to 14 miles per hour without any inconvenience.

The composition of the Aberdare Four Feet Vein, the coal now in use in these engines, is

Carbon,	90·25
Hydrogen,	4·12
Oxygen,	2·25
Nitrogen, &c.,	2·13
Ash,	1·25
	100 00

It is therefore practically coke, and requires only proper treatment for substitution in the place of coke. Another great advantage in the use of this coal over all others in locomotive engines is its almost entire freedom from smoke, thus rendering any plan of smoke-burning unnecessary, not even a steam jet being required when the engine is standing.

The advantage of slow speed is so distinctly shown in the results obtained that the writer considers this point as worthy of more attention than it usually receives on railways: for a slow speed not only economizes the quantity of fuel consumed by diminishing the resistance of the train, but also increases the evaporative duty obtained from it.

Discussion.—Mr. Tomlinson explained that the firebrick was merely broken up into small pieces of about 3 inches cube, and thrown in roughly with a shovel in a single layer over the grate, so as to cover the firebars; it was found to last a long time, and in one special trial that he had made to ascertain its durability the fire was not dropped for six days, the engine running continuously 100 miles per day, and at the end of that time the firebrick still remained as an efficient protection for the grate bars. The thickness of the fire was an important point: it might be 9 or 10 inches thick at the sides, where the absorbing surfaces of the firebox kept down the temperature; but should be as thin as possible in the centre, so that the bars could just be seen through it, for the bars would go down in the centre in spite of all precautions, unless the fire was kept very thin, on account of the intense heat. By the experiments the injurious effect of increased speed was remarkably shown, not only in increased consumption of fuel, but also in diminished evaporative duty of the fuel, which was reduced about 10 per cent. by an increase of speed of $5\frac{1}{2}$ miles per hour, or about 50 per cent. In the trial that he had made of Newcastle coal, he had found that the bituminous Newcastle coal demanded very different circumstances for its economical consumption, requiring a much greater supply of air; it consequently received imperfect treatment in ordinary locomotive fireboxes, where no provision was made for an extra supply of air beyond that admitted through the grate; so that the evaporative duty obtained in the trial was only $5\frac{1}{4}$ lbs. of water per pound of fuel.

The results of the trials in consumption per ton per mile were not always thoroughly reliable as a means of comparison, on account of the great fluctuation in the weight of trains down, some being as much as 700 or 800 tons down hill, which would materially affect the result; the fall was nearly uniform from one end of the line to the other, amounting to 409 feet in 24 miles, or an average gradient of 1 in 309. The coke cost 12*s.* 6*d.* per ton and the coal 6*s.* 8*d.* per ton in the wagons upon the railway; so that the cost of fuel when coal was used was little more than half of that with coke, as the consumption was about the same in quantity to do the same work.

Mr. R. Laybourn said he had made some trials of burning Welsh coal in locomotives on the Monmouthshire Railway, about eighteen months ago, with coal from Nixon's Deep Duffryn seam, the same seam of coal as the Aberdare Four Feet Vein, but found the bars came down in the way described: this was obviated by using inferior coke for lighting the fire, which formed a portion of clinker over the bars that served to protect them; by this means he succeeded in using the coal. He had made a series of experiments, which led him to the adoption of a considerable proportion of coal mixed with the coke for the locomotives on the Monmouthshire Railways. In the half year ending December, 1855, and previously, coke alone had been used, at an average rate in that half year of 40 lbs. per mile for all the trains, passenger and goods, costing 3·12*d.* per mile of the trains for fuel. In the following half year to June, 1856, a quantity of coal was mixed with the coke; and in the next half year to December, 1856, this was increased to an average of 22·73 lbs. of coal per mile and 17·85 lbs. of coke; making a total consumption of 40·50 lbs. per mile, at a cost of 2·56*d.* per mile of the trains for fuel. The proportion of coal was then further increased, and the results were:—

In the half year ending	Coal.	Coke.	Total Consumption.	Cost of Fuel.
June 1857,	39·25 lbs.	5·60 lbs.	41 85 lbs. per mile.	2·09*d.* per mile.
Dec. 1857,	39 71	5·20	41·91 "	2·13 "
June 1858,	34·15	7·21	41·36 "	2·10 "

He had not tried firebrick, but by getting up the fires with inferior coke a clinker was formed over the grate, which was found to answer the purpose of protecting the bars.

Mr. Tomlinson said that the weights given in the tabular statement of experiments were those of the trains alone, independent of the engine and tender, which would add about 45 tons, the engine being about 29 tons weight and the tender 16 tons.

Mr. B. Fothergill had been engaged recently in experiments on this subject, and he agreed entirely with the statements in the paper, as to the efficiency of coal for locomotives in place of coke; and that the quantity of coal required was not greater to do the same work, if suitable provision was made for its proper combustion. His experiments had been made with the partially bituminous coal of Lancashire and Yorkshire; and he had also made one trial with the Welsh smokeless coal in a locomotive engine, but it was impracticable to complete that trial in consequence of the firebars melting down upon the trip, so as

to stop the engine after having run only a short distance. It was not from defect of the coal that this stoppage of the trial took place, but entirely from the melting of the firebars; and it was evident that without some provision for protecting the bars from melting, the Welsh smokeless coal could not be employed in locomotives. In two trials he had made, the cost of fuel for taking the same train over the same distance of 96 miles was found to be with coke at 11*s.* 6*d.* per ton, 22*s.* 3*d.*; with coal at 5*s.* 3*d.* per ton, 9*s.* 5*d.*; showing a saving of 57 per cent. in the cost of fuel consumed when coal was used. Locomotive engines using coal might always be made to burn their smoke satisfactorily. A point of great importance was the relative durability of the boiler tubes and firebox with coal and with coke; and after the practicability of using coal with great economy in cost of fuel had been established, this became a serious question in deciding whether to go on making coal-burning engines instead of coke engines. It had been feared at first that there would be a loss from more rapid destruction of the brass tubes and copper firebox with coal than with coke; and he had been recently engaged in an investigation of the subject on the London and South Western Railway, where coal-burning engines had been worked for a long time, for the purpose of ascertaining the real lifetime of the tubes under the two circumstances. The result was found to be that in twenty-six coke-burning engines the average duration of a set of brass tubes was 94,518 miles, varying from 65,000 to 127,000 miles, according to their quality, and the description of coke used. But in several engines running with half coal and half coke, the tubes had run 154,955 miles, and were still in good working condition; and in one of these engines the tubes after 137,676 miles work were not half worn out, and were reduced in thickness only from No. 13 to No. 16 wire gauge, or from ·095 to ·065 inch. From the results of this investigation he was satisfied that the ordinary wear of the tubes was caused mainly by the cutting and abrading action of the hard particles of coke drawn rapidly through the tubes, and was not entirely a chemical action as had been at first supposed; and consequently the comparative softness of the particles of coal greatly reduced this cause of wear. This was illustrated by the wear that ordinarily took place in the fire boxes of coke engines, in which the roof and upper portion were reduced only $\frac{1}{32}$-inch in thickness, whilst under the firedoor and at the lower part of the sides, where exposed to the continued wear of the hard pieces of coke, the thickness became reduced $\frac{1}{8}$-inch in the same time. He was satisfied that the durability both of tubes and fireboxes would prove much greater with coal alone; and that there was no ground to fear more chemical action from sulphur with coal than with coke.

Mr. Tomlinson said that the quantity of sulphur in the Welsh steam coal was very small, and was included in the 2·13 per cent. of nitrogen, &c.; in the Four Feet Vein the proportion of sulphur seldom exceeded from 1 to $1\frac{1}{2}$ per cent., and was never more than 2 per cent.

Mr. W. G. Craig said he was satisfied that the tubes had a much greater durability with coal than with coke. For the purpose of burning coal he had used a firegrate constructed with each alternate bar

raised one inch above the others, making a kind of hollow fire, leaving spaces for air to enter under the fuel; the bars were not found so liable to burn in that arrangement as with a level grate, being protected by a greater supply of air on their top surface; a set of bars now lasted several weeks with coal, instead of only one week as before when they were all level.

Mr. J. FENTON observed that the low evaporative duty obtained from the Newcastle coal, when burnt without consuming the smoke, showed the great importance of insuring a sufficient supply of air for bituminous coal, and a considerably larger quantity than was required for a coke fire.

Mr. W. SMITH remarked that he had seen a construction of cast iron channelled firebars by Mr. Gray, in an application of which every alternate bar was raised about $1\frac{1}{2}$ inches above the rest: sloping notches or channels were made across the top edges of the bars, to afford an increased area for supply of air; several sets were at work in London, burning coal, and they appeared to answer satisfactorily, giving an increased supply of air, and lasting longer than the ordinary bars from the greater cooling effect of the air.

Mr. TOMLINSON said he had tried a set of Mr. Gray's firebars for a stationary engine grate under a large Cornish boiler, but had not found there was much advantage over a set of thin cast iron bars which he had tried in a companion boiler of the same description; the latter bars were $3\frac{1}{4}$ inches deep by $\frac{3}{4}$-inch thick at top and $\frac{1}{2}$-inch at bottom, with $\frac{3}{4}$-inch spaces. In both boilers the firedoors were perforated in the same manner as the locomotive firedoor, and provided with sliding shutters to close the air holes; there was also a damper below the fire to shut up all close when the incline was not being worked. He thought that in practice the channels across the bars were more frequently filled with dust than clear, and hence the absence of any good effect resulting from them. The bars that he used for locomotives were wrought iron, $4\frac{1}{2}$ inches deep by $\frac{7}{8}$-inch thick at top and $\frac{5}{16}$-inch at bottom, and $\frac{5}{8}$-inch spaces when new. In some engines the same set had lasted five months when burning about 45 lbs. of coal per mile and running about 500 miles per week: their average duration was about three months, which was gradually increasing.

Mr. R. LAYBOURN observed that an important consideration in the matter was the great variation in the quality of coal obtained in different districts, so that a special plan had to be arranged on each different railway to suit the coal to be used there. He had made a trial of a plan of firegrate by Mr. Jeffreys, of the Shrewsbury and Hereford Railway, in which the bars were laid flatways on the side instead of the edge, with air spaces between, and partly overlapping one another, forming a gradually sloping surface from each side of the firebox down towards the centre; this arrangement proved successful in admitting a larger supply of air, and he found it effective in burning the bituminous coal.

Mr. MAUDSLAY observed that this was similar to Mr. Crampton's firegrate, that was used on the French railways, except that in the

latter the bars were laid transversely instead of longitudinally in the firebox, forming a surface sloping down from the firedoor towards the tube plate.

Mr. E. A. Cowper observed that in Mr. Gray's plan of firebars that had been referred to, the general arrangement he believed was to have ½-inch bars and ½-inch air spaces, giving 50 per cent. area of opening in plan for the admission of air; but the effective area was increased to 60 or 70 per cent. by cutting sloping notches in the top edges of the bars, so that portions of the top surface of the bars were cut away. He did not know what were the results of their working, but thought the use of very thin bars fully answered the purpose required; he usually employed bars only ½-inch thick at top and ¼-inch at bottom, with ⅝-inch spaces.

Mr. Tomlinson said that a set of Mr. Gray's firebars had been tried for some time in the "Iron Duke" locomotive engine on the Great Western Railway; but he did not think any plan of stepped grate would be suitable for burning the Welsh coal, for he found that if any one of the ordinary bars was accidentally left standing up above the others, from the notch in the firebar frame not being cleaned out, it was sure to get burnt more than the rest.

Mr. E. A. Cowper had heard that a plan had recently been tried in some locomotives on the Great Western Railway, for tipping up the entire firegrate upon a centre bearing, so as to allow of laying the fresh fuel on the bars, and then covering it over with the red fire when the grate was tipped back again sharply.

Mr. R. Laybourn believed that was Mr. Jeffreys' plan, and was intended as a mode of making cast iron bars suitable for locomotive firegrates; this was effected by never disturbing the cast iron bars on their bed, and they were never removed until worn out; but when the fire had to be dropped the whole frame was tipped over on a centre bearing, allowing the fuel to drop out. This plan gave great economy in the cost of maintenance of firebars, as cast iron was used instead of wrought iron bars; and the bars were preserved from injury by avoiding the handling of them whilst hot, which was liable to bend or break them.

Mr. J. Fernie said an arrangement of ridged firebars had been tried for a stationary engine boiler at Derby, on Mr. Chanter's plan, in which the top of the bars was ridged or serrated, and every alternate bar was moved longitudinally about 1 or 1½ inch backwards and forwards, the intermediate bars remaining stationary; the alternate bars were moved by a transverse shaft provided with a lever, which was moved occasionally by the stoker. These had been in use about two years, and were found to answer the purpose satisfactorily; the ridges on the bars served to keep the fire gently stirred, preventing clinkers from adhering to the bars.

Mr. W. G. Craig observed that for burning coal it was requisite to have the bars rather close together and very thin, considerably more so than with coke; and the object he had in view in using a grate with the alternate bars raised above the others was to admit more air under

the fuel, making a kind of hollow fire, to prevent the bars from burning. The firebars he used were $\frac{7}{8}$-inch thick at top and $\frac{1}{2}$-inch at bottom, with $\frac{3}{4}$ to $\frac{7}{8}$-inch air spaces, and when placed alternately raised, they could be brought still closer.

Mr. J. E. CLIFT inquired whether a pan of water had been tried under the firegrate, to prevent the bars being burnt; that plan was frequently used in stationary engines with good results, and by this means he had had firebars in constant use for two years with intense coal fires under gas retorts, without the bars burning away. There was constantly a supply of water under the firegrate, and the steam rising from it served to keep the bars continually protected and cool.

Mr. TOMLINSON said he had tried a jet of water from the boiler kept continually running under the firegrate of a locomotive during the whole trip, but it did not serve to protect the bars from burning; he had not tried a pan of water, but with the jet there was so much water constantly supplied as to keep the ashpan full of steam, and he thought the effect would be the same as in the use of a pan of water.

Mr. C. W. SIEMENS observed that the efficiency of the water below the firegrate would depend a good deal upon the quantity of ashes falling from the fire; if the ashes fell easily they would keep up a supply of steam from the ashpan and preserve the bars from injury; but if much clinker were formed on the firegrate, the water pan would not answer, as there would not be steam enough to keep the bars cool.

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*On a New System of Axle Boxes, not requiring Lubricating, and without Liability to Heating.** By ALPHONSE DE BRUSSAUT.

The author first recapitulated the liability to accident arising from inattention to the constant greasing of the ordinary axle boxes and journals of carriages and of machinery, the inconvenience of accumulating dust and grit on the bearings, and the friction and wear and tear arising from these causes. He then reviewed the numerous inventions and attempts to remedy these evils, showing that none of them had hitherto successfully abolished the necessity for the expensive and uncleanly use of some lubricating matter. He next proceeded to describe the system which he had introduced, and had applied somewhat extensively in France to various classes of machinery in which the use of grease had hitherto been considered indispensable. The new apparatus was described to consist of a series of four, six, eight, or any other convenient number of cylindrical rollers of the length of the journal, retained at certain distances apart from each other, yet still united by elastic bands of vulcanized india rubber. These rollers, thus united, and placed around the journal, would be set in motion by the pressure of the axle, without the possibility of collision with or friction against each other, or of rubbing upon the surface of the journal or of the bearing, and thus avoiding as much as possible any friction or opposi-

* From the Lond. Civ. Eng. and Arch. Journal, May, 1859.

tion to the motion of the journal. The action of rolling being thus substituted for sliding, there could not be any abrasion of the substances, and lubricating became unnecessary. The machines so fitted were stated to work with remarkable ease and steadiness, and to be set in motion and the speed to be kept up with considerable facility. No inconvenience had been experienced from the fracture of the elastic bands and shafts, making 450 to 500 revolutions per minute, working perfectly well, without any symptom of heating.

The reasons for this action were stated in a plain and comprehensive manner by showing that in moving a body of an octagonal form along a plane the action must be either by sliding or by rolling; in the former lubrication was necessary, whereas in the latter the presence of any lubricating matter would be prejudicial. Extending the latter principle to the cylindrical form, which was merely a body having an indefinite number of sides, it was evident that by retaining these cylinders apart by means of the elastic bands, so as to avoid friction against each other or upon the journal or the bearing surface, a practically perfect rolling motion would be obtained, and it was contended that by M. Brussaut's system the two material results of rapid rotation without heating, and a complete suppression of the use of grease in all journals of machinery were arrived at.

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*Cheap Railway Fare.**

We see by the time tables that the South Western Company are carrying passengers in covered carriages on Sundays to Portsmouth and back for 4*s.* each. We do not say that this is any thing extraordinary for a railway company in these days to do, but as the distance to Portsmouth is 94½ miles, a passenger is thus carried 189 miles for 4*s.*, or just about ¼*d.* per mile, which surely is cheap enough.

It is difficult to run a train, especially a long one, for less than 2*s.* per mile, including every expense commercially chargeable against it. It would therefore require 200 passengers at ¼*d.* per mile per passenger to be in a train, in order to work at about 50 per cent. expense; to net half the receipts as profits. We do not know how many passengers these very cheap trains (to Portsmouth, Salisbury, &c.,) average, but we dare to say it is not less than 200. It is work almost as cheap as carrying coals at ½*d.* per ton per mile. If no more passengers than 200 are found in such train, it is in point of fact cheaper than coals at ½*d.* a ton a mile.

Such cheap fares are calculated to render railway traveling popular, and if the million can be attracted to the railway, benefit will follow to the railway companies and the public, for nothing is more healthy than a trip every now and then in the country, and as it is the case, that as many as 500 or 600 persons can be easily conveyed in one train, fares of only ¼*d.* per mile per passenger would be handsomely remunerative obtained from a train filled with so many passengers.

* From Herapath's Railway Journal, No. 948.

AMERICAN PATENTS.

List of American Patents which issued from April 19 to May 10, 1859, (inclusive,) with Exemplifications.

APRIL 19.

216. Steam Boiler Furnaces; Jonathan Amory, West Roxbury, Massachusetts.

Claim—The method of increasing the combustion and protecting the combustion curves, as described.*

217. Device for Converting Alternate Circular Motion into Direct Circular Motion; Abraham Bartholf, City of New York.

Claim—The dog, spring, and lever, combined and arranged relatively to each other and applied to the wheel, or its equivalent, as described.

218. Burial Cases; A. C. Barstow, Providence, Rhode Island.

Claim—Constructing a metallic burial case with the ogee-shaped ends, whereby great reduction in weight and economy in the manufacture is secured, and at the same time all the space required afforded. Also, forming the metallic case with the overlapping strengthening ribs.

219. Furnace for Heating Tire; M. Battel, Albany, New York.

Claim—A furnace, composed of an annular body, fire space, central tube, with cover or damper therein, to regulate the draft, extension, rod, crane, top, and otherwise constructed as described.

220. Anchor Tripper; T. L. Baylies, Richmond, Indiana.

Claim—The arrangement and combination of the tripping bar, shaft, and cams, as described.

221. Machine for Filing Saws; A. M. Beardsley, Elkhart, Indiana.

Claim—1st. The arrangement of the swinging frame of the file carriage upon the adjusting plate, so that it can be turned over and supported upon the bed-plate, in the manner described. 2d. The arrangement of the check pieces upon the adjusting plate, between the arms of the swinging frame, for the purpose of bracing the latter against the thrusts of the file carriage, while said frame is free to rise and fall. 3d. The arrangement of the gauging screw in the cross-piece of the swinging frame, by which the teeth are filed to a uniform depth, without interfering with the rising of the file carriage, to conform to the taper of the file. 4th, The arrangement of the seats at each end of the bed-plate, whereby the implement may be supported directly upon the clamp of the saw.

222. Artificial Legs; Douglas Bly, Rochester, New York.

Claim—The use of an elastic strap or apparatus from the shoulders, or upper part of the body, when attached to the artificial leg in such a manner that its contractile power is exerted in connexion with the backward motion of the shoulders, to produce the forward motion of the foot.

223. Washing Machines; Benjamin Bradbury, Abington, Illinois.

Claim—The arrangement of the levers and pitman moving the dashers over the concave of the box.

224. Faucets; C. K. Bradford, Lynn, Massachusetts.

Claim—The faucet, to be operated by applying pressure directly to the head of the case, said case for this purpose being provided with an outside elastic diaphragm forming the head thereto, and combined with a valve rod, arranged in relation to the case internally, so that the ends of said rod terminate respectively at, and are secured to, the valve and diaphragm.

225. Bedstead; Wm. H. Bramble, Springfield, Ohio.

Claim—1st. The combination of an under and upper section, united to each other by springs and links, so that the upper section may have a free, vertical, and horizontal motion. 2d. In combination with a bedstead made of two sections, the making of the posts of the upper section shorter than the supports of the under section, so that said upper section, when placed on the lower one, shall be entirely clear of the floor. 3d. The combination of the loose slats, springs, and webbing, when said webbing runs longitudinally or lengthwise of the bedstead.

226. Cooking Range; B. Wells Dunklee, Boston, Massachusetts.

Claim—The arrangement of the two induction flues, the gauge throats, their plates or bars, and the flues around and between the two ovens, a single damper, and its openings, being placed over the middle flue, and with respect to the two flues.

227. Governor for Steam Engines; John Broughton, City of New York.

Claim—Effecting the connexion between the ball arms and the central rod, by means of two levers and two links, applied and operating as set forth.

228. Lubricator; P. G. Brown, Schenectady, New York.

Claim—The combination of the reservoir, provided with a discharging aperture, valve, having a receiving aperture in it, and air chamber, or the equivalents thereof, when said air chamber is arranged to control or assist the discharge. Likewise, giving to the valve which conveys the oil from the reservoir to the discharging aperture an intermittent revolving motion, in one and the same direction, for and by the action of the handle, in either direction of the travel of the latter, or in reverse directions thereof.

229. Lock; George Clay, City of New York.

Claim—The arrangement of the following parts for united operation in a lock, viz: right and left double-walled case, sliding right and left key-hole guard plates, right and left forked bars, main and auxiliary tumblers, and bolt.

230. Railroad Car Brake; Wm. E. Cooper, Dunkirk, New York.

Claim—The arrangement of the bell cord, pulleys, and movable pulley block, with the brake cord, connected and operated for the purpose of setting all of the brakes in the entire train, simultaneously and from any point within the train.

231. Journal Boxes; Rienza Daniels, Almena, Michigan.

Claim—The axle furnished with a screw-tapped arm, and having toothed and plain sections of a journal

arranged and clamped upon it, in combination with the internally toothed journal box, and with rods, toothed and plain sect ons of frictional rollers, arranged and clamped on them, in the manner described.

232. HARVESTING MACHINE; George Esterly, Whitewater, Wisconsin.

Claim—1st, The adjusting of the rake by means of the socket, suspended by journals or trunnions, and secured in the desired position by set-screws and bars, or their equivalents, in combination with the adjustable platform, whereby the rake and platform may be adjusted to suit the height the grain is being cut. 2d, The segment plate with the curved flanch, for the purpose of carrying the rake backwards. 3d, The use of the pendant rod or bar provided with the rollers, in combination with the flanch I do not claim the guard finger—but I claim, fourthly, attaching the guard finger to the bearing, in the manner described, whereby it may be adjusted, for the purpose specified.

233. MACHINE FOR QUARRYING STONE, &c.; Jonah Ellis, near Warrington, England; patented in England, December 6, 1855.

Claim—A portable apparatus, designed for cutting grooves in rock, or other mineral substances, for the purpose of quarrying the same in blocks, and consisting of supports which are fastened to the rock and sustain an adjustable bed-plate and screw-shaft, upon which bed-plate and screw-shaft a tool stock and adjustable cutter is made to traverse between two previously drilled or open spaces which form the extremities of the proposed cut.

234. WATER-COOLER FOR STEAM ENGINES; Robert G. Eunson, City of New York.

Claim—The use or employment of a decalorator, such as is described, or its equivalent, when the series of very small horizontal tubes are so arranged in respect to the current of water outside of the tubes, that the centre of each tube, in one row, shall be opposite, or nearly opposite, to the centre of the space between the tubes in the next row, in combination with supporting and directing tube plates, as described. Also, the use or employment of tubes, arranged in rows, in combination with the tube plates and shell of the decalorator, when so arranged that the current of cold water is made to flow across the tubes, being directed by the tube plates from side to side or from top to bottom, and from bottom to top of the shell, and around the tubes, being made to encircle them by its current, in consequence of their arrangement of rows, and at the same time, progress lengthwise of the shell and tubes in a direction contrary to the stream of fresh water inside of the tubes, for the purposes set forth.

235. FIREMAN'S LADDER; Daniel Fitzgerald, City of New York.

Claim—1st, The applying the tanks, or their equivalent, to ladders, with or without water, to elevate and hold said ladders, as described. 2d, Conveying the water through a long distance by an elongated pipe, or its equivalent, connected with the apparatus. 3d, Managing the curved or jointed pipes, by means of the lever, in the manner described.

236. MOULDS FOR STEEL CASTINGS; Perry G. Gardiner, City of New York.

Claim—1st, The constructing the mould with a cup or reservoir for holding all the melted metal for casting, closed and opened at the entrance of the sprue by the movable plug or stopper. 2d, The spherical hollow chamber, and air escape passage, and self-acting plug, to permit the rarified air to pass from the mould, and to escape, and to shut off the external air from the mould. 3d, The combination and arrangement of the two cups, the sprue, the figure, the tool or casting, and air-vents or passages, so as to form a bent tube by which the casting is filled from the bottom, and the external air excluded. 4th, The use of the moulds in a state of intense heat, never less than 500° Fahrenheit, and generally at a much higher temperature, for the purpose of producing, as nearly as practicable, a vacuum within the mould—but I do not claim the mere heating or warming of the moulds to produce a smooth casting, that having been a common practice heretofore.

237. MACHINE FOR SMOOTHING SOLES OF BOOTS AND SHOES; Othniel Gilmore, Raynham, Massachusetts.

Claim—The improved manufacture of a sole-smoothing or reducing wheel, made with the convex grinding annulus, concentric heel recess, and acute angled edges.

238. OVEN FOR COOLING CASTINGS; P. F. Geisse, Wellsville, Ohio.

Claim—The pipe, connecting the eyes or hubs of the wheels with flues and plate, for causing the current of air to pass through the eyes only of the hubs in cooling, in combination with heating oven and pits, operating as described.

239. MODE OF ATTACHING CASTERS TO TRUNKS; Isaac H. Giffing, City of New York.

Claim—The method described of constructing and attaching casters to trunks.

240. YOKE-RING ATTACHMENT FOR THE POLE OF OX-CARTS; James C. Gilbert, Leeds Junction, Maine.

Claim—The arrangement of the backing bearer and engaging notch of the spring-slider, with respect to, and to operate with, the draft hook.

241. ATTACHING CORDS TO WINDOW SASH; Porter A. Gladwin, Bristol, Massachusetts.

Claim—The employment of the slotted tension spring or plate, in combination with the cord and pulley, in the manner described.

242. WINDLASSES; Wm. P. Goolman, Dublin, Indiana.

Claim—1st, In combination with a winding drum or capstan of any suitable form, the application of a reel operated by the traction of the entering cable, to take up the slack from the said drum or capstan. 2d, In combination with the said reel and capstan, the adjustable idle pulley, operating to maintain the needful traction of the cable against the reel, or vary it as may be found needful.

243. PRINTING PRESSES; George P. Gordon, City of New York.

Claim—1st, The combination of one or more sets of revolving grippers with the finger stops, or their equivalents, for the purpose of piling the sheets of paper in an even and regular heap or pile. 2d, The combination of a vibrating feed-board with the rotating or revolving platen, for the purpose of feeding the sheets of paper regularly with precision at each rotation of the platen. 3d, The combination of a rotating reciprocating bed with a revolving platen.

244. BENCH PLANE-STOCK; Jackson Gorham, Bairdstown, Georgia.

Claim—Constructing the plane-stock of a central wooden portion secured between metal side-plates provided with flanches, the part, a′, being permanently secured between the plates, and the part, a, rendered adjustable between said plates by set-screws.

245. COTTON GINS; Edward Gottheil, Galveston, Texas.

Claim—1st, The method of feeding the cotton bolls to the rollers, by means of a blast issuing from a

slotted or perforated tube. 2d, The arrangement of the two cylindrical brushes, in combination with the rollers, when the former are so constructed that a blast from an independent source may be forced through slots or perforations in their peripheries. 3d, The comb, in combination with the blast pipe, for gathering the lint off the upper brush roller and discharging it into its receptacle, in the manner set forth.

246. Surveyors' Chain; Josiah M. Grumman, Brooklyn, New York.

Claim—1st, The method of making civil engineers' and surveyors' chains of a peculiar form of link, as described. 2d, The arrangement of spring-balance and level in the same tube or covering, with the arrangements for adjusting. 3d, The method of allowing for the variation of the temperature by a scale of variation on the chain with the adjusting slide and clamp, so that the chain may be virtually shortened or lengthened to meet the temperature. 4th, The use of the spring catch, by means of which the balance and level is detached from the end link and attached to any other link in the chain at the pleasure of the operator. 5th, The method of attaching the thermometer to the end bar of the chain.

247. Bustles; Isaac W. Hakes, Jr., and A. H. Hakes, Norwich, Connecticut.

Claim—A "bustle," provided with front holding-straps and spring, when otherwise constructed.

248. Cooling and Feeding Material to Mills; B. Q. Harrington and U. B. Burris, Missouri City, Missouri.

Claim—1st, The spiral chambers, for the purpose of creating currents of air for keeping the stones cool. 2d, The combination of the spiral buckets with the spiral chambers, when both are arranged in the manner set forth.

249. Chairs for Railroads; Alex. L. Holley, City of New York.

Claim—The combination of the splice and the bracket (the said splice and bracket being either the same piece or separate pieces), with the foot of the rail acting as a tension piece, or with a separate tension piece, in the manner described.

250. Variable Cut-off Gear for Steam Engines; Alex. L. Holley, City of New York.

I disclaim the method described of moving the supplementary valve, the same being in use. I disclaim the use of a supplementary steam piston as the sole mover of a valve.

Claim—Such a combination of the motion of an eccentric, or its equivalent, with the motion of a steam piston for moving a valve, as will effect a variable cut-off of the induction steam, without interfering with a free exhaust, substantially in the manner described.

251. Variable Cut-off Gear for Steam Engines; Bennet Hotchkiss, New Haven, Connecticut.

Claim—The combination of the sliding bar with the sliding collar, when constructed, arranged, and made to control the time of the cut-off by the operation of the governor or regulator only.

252. Corn Shellers; Wm. H. Hovey, Springfield, Massachusetts.

Claim—The arrangement and combination of the endless elevator, the spout, the spring presser, and the shelling cylinder. Also, the arrangement and combination of the grated trough with the elevator and the mechanism for removing the kernels from the cobs, and separating both kernels and cobs, such mechanism consisting mainly of the presser, the shelling cylinder, and the grid or bar. Also, the combination and arrangement of the guide hopper or receiver with the shelling mechanism, the grated trough, and the elevator, in the manner specified.

253. Corn Shellers; James J. Johnston, Alleghany, Pennsylvania.

Claim—The combination and arrangement of the discs or shelling wheels with the guard, guide, and spring or press-plate, constructed in the manner specified.

254. Combined Stump Extractor and Press; George Kenny, Milford, New Hampshire.

Claim—1st, The combination of the main frame, anchor frame, canting frame, with the shaft and the devices for working it. 2d, The main frame and windlass device, in combination with the removable pressing frame and box, as set forth.

255. Apparatus for Drying Shoe-pegs and Grain; Samuel Kimball and Wm. Sawyer, Boxford, Mass.

Claim—The arrangement of the steam pipes with the main cylinder, covered with wire gauze or perforated sheet metal, in whatever manner the steam may be introduced into said pipes, in combination with the floats, constructed and operating in the manner set forth. Also, the arrangement of the steam pipes with the main cylinder, covered with wire gauze or perforated sheet metal, without the floats, constructed and operating in the manner set forth.

256. Pumps; A. C. Laning, Wilkesbarre, Pennsylvania.

Claim—The stationary pipe or tube, valve chamber, and reciprocating cylinder, combined and arranged as set forth.

257. Brick Machines; David Locke, Lexington, Missouri.

Claim—The elevated layer of tempered clay, arranged in connexion with the traveling plates or cutters and pressure plates, to operate as set forth.

258. Shingle Machine; H. H. Low, Galena, Illinois.

Claim—Operating the vertically reciprocating and balance frame from the saw or power shaft, through the medium of the pulleys and gearing, arranged with the slide bar, arm, and the springs and spring stop, as set forth.

259. Cob and Grain Mill; John R. Marston, City of New York.

Claim—The set bolt with its nut, or its equivalent, the slot in the shell of the cob-cutter, and the collar on the shaft, for the more practicable and reliable mode of retaining the cutters of the cob mill in their proper places.

260. Egg-beater; James F. Monroe, Fitchburgh, Massachusetts, and E. P. Monroe, City of New York, Assignors to E. P. Monroe, aforesaid.

Claim—The two beaters, constructed of wires and arranged in the adjustable frame, in such a manner that the same, by means of pinions, and by the bevel wheel, receive a rapid rotary motion in opposite directions.

261. Iron Carriage Wheel; John D. Murphy, Baltimore, Maryland.

Claim—A combined wrought and cast iron wheel, when the several parts composing said wheel are constructed in the form, and arranged and combined in the order, as described. Also, having the entire rim of the tread of the wheel open at one place, as shown at d', until after the hub is cast, in combination with the mode of inserting and fastening the spokes in the rim or tread of the wheel.

262. SKATES; Isaac W. and Frederick M. Norcross, Lowell, Massachusetts.

Claim—An improved mode of arranging and applying the spring, each being a continuation of the runner, and to extend laterally and longitudinally with reference to, and to be fastened at, the toe and heel of the foot-stand, as specified.

263. APPLYING ELECTRICITY IN DENTAL OPERATION; Wm. G. Oliver, Buffalo, New York.

Claim—The employment in producing local anesthesia in dental operations, of an apparatus, in which only non-metallic conductors are brought into contact with the parts being operated upon, as set forth.

264. RAILROAD CAR COUPLINGS; George W. Parshall, Middlefield, New York.

Claim—The construction and combination of the head-piece, tongue, wheel, and pin, arranged and operating as described.

265. SNOW PLOUGHS FOR RAILROADS; Willard Rhoads, Baltimore, Maryland.

Claim—The projecting flanch, in combination with the vertical sides, in the construction of the railroad track clearers.

266. SASH CORD FASTENER; Joseph R. Payson, Covington, Kentucky.

Claim—The cylindrical ring, in combination with the opening, neck, and eye, as described.

267. WEIGHING SCALES; Samuel Pierce, Cambridgeport, Massachusetts.

Claim—The combination and arrangement of the two poise slides and the fulcrum block, in the manner specified.

268. FLUID MEASURER; James L. Perry, Mansfield, and Melzer Burt, Norton, Massachusetts.

Claim—The fluid measurer, constructed substantially in manner, and to operate with respect to a barrel or reservoir, as specified—that is to say, as made of a close vessel, induction and eduction faucets, and a tell-tale valve and valve openings, or equivalent, the valve serving to indicate when the case may be full of liquid, the induction faucet allowing the flowage and interruption thereof of liquid into the case, and the eduction faucets determining the amount of flowage out of the case.

269. MILLS FOR GRINDING, CRUSHING, &c.; Philander Perry, Troy, New York.

Claim—The specified arrangement for effecting the combination, in one machine, of the grinding mill, cob-crusher, corn sheller, and straw cutter.

270. MACHINES FOR MAKING DRAIN PIPES; Bradford S. Pierce, New Bedford, and Mason K. Pierce, Mansfield, Massachusetts.

Claim—The arrangement of the mixing apparatus, pressing and core-relieving devices above the platform for conveying the moulds, in the manner specified. Also, the arrangement of the core-socket upon the revolving disk to receive the core and the mould, with a provision for discharging the core through the platform.

271. JOURNAL BOXES; Wm. S. Pratt, Brooklyn, New York.

Claim—The rollers, D D, placed between the rollers, C C, in the position and for the purposes specified.

272. CAR COUPLINGS; H. Purlier, Jesse Harlan, and E. C. Cheek, Cincinnati, Ohio.

Claim—The employment of the tripping-pin, in combination with the latch-lever, arranged and operating as described.

273. HYDRANTS; Washburn Race and S. R. C. Mathews, Seneca Falls, New York.

Claim—The combination and arrangement of the parts, consisting of the cap, having within its socket the spring, or its equivalent, stem attachment, interior tube, conical valve, and closed seat, whereby the valve is kept in place by the force of the spring, and operated free from the external pressure of the water.

274. HARVESTING MACHINES; Samuel Ray and Moses R. Shalters, Alliance, Ohio.

Claim—1st, Attaching the finger bar to the machines by means of the plate, one end of which is pivoted to the machine, and the other end connected with the finger bar by joints, the above parts being in connexion with a jointed connecting rod to admit of the folding and turning of the finger bar. 2d, Placing the driver's seat on the springs fitted in the hollow standards.

275. FOLDING SEAT; T. Reeve and M. B. Swezey, Brooklyn, New York.

Claim—The seat, B, attached to the end piece of the pew or settee by the pin of the bar, and the slot in the end piece, and provided with the hinged back and support, arranged as set forth.

276. MACHINES FOR TEMPERING AND MOULDING PLASTIC MATERIALS; Silas C. Salisbury, City of New York.

Claim—The employment of a series of two or more cylinders and the intervening guard blocks, in combination with a cylinder of larger diameter provided with flanches on its ends, so that the periphery of the larger cylinder, with its flanches, and the opposing surfaces of the series of cylinders and guard blocks, shall constitute the walls of a channel in which the plastic material, on its passage to the die or mould, is worked, tempered, and pressed, as set forth. Also, giving to the surface of the cylinder a greater velocity than the surface of the large cylinder, for the purposes set forth. Also forcing the plastic material into the die, between the cutting edges, by the pressure of a coat or layer of plastic material, formed on and adhering to the periphery of the large cylinder.

277. REVOLVING FIRE ARMS; Jacob Rupertus, Philadelphia, Pennsylvania.

Claim—1st, The safety tube, constructed as specified. 2d, Producing the necessary movements of the safety tube, by means of a forked or toothed lever, spring, or its equivalent, and a tooth on the tumbler, the whole being applied and operating as described.

[A magazine is provided for percussion caps or pellets within the hammer of a fire arm. A feeding slide is applied to the hammer and its contained magazine, which is operated as the hammer falls, causing a cap or pellet to be delivered from the magazine in front of the face of the hammer, and so interposed between the hammer and nipple as to be exploded by being driven by the hammer in contact with the nipple or surface surrounding the vent. There is also a mode of applying and operating a piston to push forward the caps remaining in the magazine after every delivery made by the feeding slide, whereby the inventor is enabled to obtain the greatest length of magazine that the size of the hammer admits of. Half of this patent has been assigned to John Krider and J. T. Siner.]

278. ATTACHING THE RAILS OF CARRIAGE SEATS; Cornelius Scofield, Trumbull, Connecticut.

Claim—The arrangement of the arms, a, the ends of which form half round recesses, in combination with the arms, c, and thumb-screw, for the purpose of supporting the rail and securing the same to the seat, in the manner set forth.

279. STEAM VALVES; C. A. Schultz, City of New York.

Claim—The combined arrangement of the spiral springs and their inclosing columns with the plate, as described.

280. EXCAVATING MACHINES; Charles Schott and James C. Baldwin, Nashville, Tennessee.

Claim—The combination and arrangement of lever with its connexion with bucket, for loading and unloading, in the manner set forth.

281. TEA AND COFFEE POT; J. W. Sener, Fredericksburgh, Virginia.

Claim—The safety apparatus, consisting in the combination of the tube, and the cap, and valve, constructed as specified.

282. STOVES; S. B. Sexton, Baltimore, Maryland.

Claim—The covered fuel cylinder, in combination with the chambers, flues, and dampers, together with the rear casing, constituting a cold air chamber, the arrangement being as set forth.

283. TREATMENT OF INDIA RUBBER; Alexander Shannon, City of New York.

Claim—The method of treating caoutchouc so as to combine therewith cork, or its equivalent, substantially as set forth.

284. INSTRUMENT FOR ASCERTAINING THE DIRECTION OF SOUNDS IN A FOG, &c.; Benj. R. Smith, Philadelphia, Pa.

Claim—A reflector made of suitable material and of such a form or shape that it will collect all the rays or waves of sound entering it to a focus, when pointed towards the direction from whence sound comes, for the purpose of ascertaining the direction of the source of such sound, and conversely of throwing off from the reflector, in parallel lines, if need be, the sound of a bell or whistle, which may be placed at the focus of the said reflector, substantially as described.

285. COAL OIL RETORTS; Wm. Smith, Pittsburgh, Pennsylvania.

Claim—The making of the agitating arms hollow, and to communicate with the hollow shaft, for the purpose of cooling them by means of the current of air or water passing through the said shaft, substantially as set forth.

286. STOVES; Wm. H. Smith, Newport, Rhode Island.

Claim—The arrangement of the partitions, F F', in combination with the partitions, E, and the openings, for the purpose of forcing the hot air to circulate around and in front of the ash-box, as specified.

287. STOP-COCKS; Erastus Stebbins, Chicopee, Massachusetts.

Claim—The arrangement and combination of the collar, flexible washer, metallic washer, as described. Also, the chambered nut or valve having apertures, as set forth.

288. BRAKE-HEADS FOR RAILROAD CARS; Nathan P. Stephens, Keene, New Hampshire.

Claim—1st, Suspending the brake-heads to the ends of the transverse brake-bar by the journals and boxes. 2d, Forming cogs or protuberances on the peripheries of the journal sleeves, and interposing strips of rubber, between them and the ends of the grooves in the journal box cap, in which the said cogs or protuberances move, for causing a greater pressure to be extended on the lower than on the upper portions of the shoes, as described.

289. EXCAVATING MACHINES; George D. Stillson, Rochester, New York.

Claim—In combination with an endless belt of digging hoes, a presser-wheel, that acts independently of the weight of the machine, for driving them into the ground, as described.

290. GOVERNORS FOR SUGAR MILLS; Robert Stott, Baton Rouge, Louisiana.

Claim—In combination, the caps, the bolts, the plates, when actuated on by the employment of a weight, or its equivalent, through an eccentric movement, when arranged as set forth.

291. WRENCH; George C. Taft, Worcester, New York.

Claim—The rosette with a female screw, in combination with the stationary screw, traversing male screw, and sliding jaw, with its female screw, as set forth.

292. APPARATUS FOR DEEP SEA SOUNDING AND METHOD OF CONVEYING AND PAYING-OUT LINE FOR OTHER PURPOSES; Wm. P. Trowbridge, Washington City, D. C.

Claim—The mode of conveying and extending a line across or through a given space, by means of a weight or projectile, the line being compactly coiled within a tube or case, which is attached to the weight or projectile, and moves along with it, and is discharged from the case or holder as the weight or projectile advances, while one end of the line is retained at the starting point, as described. I do not limit my claim to the particular manner of coiling the line described, or to any one mode of giving motion to the same, which may be the force of gravity, the propelling power of a rocket or cannon, or other motive power.

293. WASHING MACHINE; Michael Van Debogert, Binghampton, New York.

Claim—1st, Subjecting the articles to be washed to the combined action of the fluted or roughened surfaces of the tube and cylinder, the two surfaces moving, in part, in opposite, and in part, in the same direction with each vibration of the cylinder. 2d, The arrangement of the means for gearing and ungearing the wheels, as recited, whereby I am enabled to give vibrating motion to both of the rubbing surfaces, as described.

294. RAILROAD CAR BRAKES; A. P. Tutton, Reading, Pennsylvania.

Claim—Connecting the two shoes between the wheels at each side of the truck, by means of racks and a pinion, whereby the shoes, when brought in contact with the treads of the wheels, are made by the action of the wheels to move simultaneously in opposite directions, and bind or wedge between them the wheels to stop the same, as described.

295. GRATES FOR FURNACES; Richard Van Velthoven, Philadelphia, Pennsylvania.

Claim—The frames with the bars forming the hinged rear of a furnace grate, in combination with the releasing and retaining cam, operated by the rod and the bracket, with its projecting chain, arranged as set forth.

296. HARVESTERS; Jacob V. A. Wemple, Chicago, Illinois.

Claim—The guard rod to separate the falling grain from that which lies on the platform, which the rack is passing down, and lay hold thereof, and also to prevent the grain from falling on the rake, arranged substantially in the manner described.

297. Railroad Chairs; J. W. Wetmore, Erie, Pennsylvania.

Claim—Notching the caps of the adjacent ends of H or T rails as at f, and the adaptation of a chair to surround the ends or joint within the shoulders of the notches, the chair forming the bearing surfaces for its length, and its leaves being bent under the base of the rail, and resting on the tie, as set forth.

298. Machine for Combing Fibrous Materials; Cullen Whipple, Providence, Rhode Island.

Claim—1st. Arranging the series of gill combs with a hot chest, or its equivalent, in such manner that said combs can be alternately sheathed and protruded from between heated plates, in the manner described. 2d, The combination of the stationary heated chest with the movable jaw, the two so combined operating to hold the fibrous substance firmly while the front end is being combed. 3d, Arranging the series of fine screen combs with the heated chest, in the manner described. 4th. The arrangement and combination of the revolving cylinder for first combing the front end of the sliver, the series of fine screen combs for combing the back end of the sliver, and the nippers for drawing the sliver through the screen combs, and delivering it upon the apron, the whole combination as arranged operating to draw and comb the wool, or other fibrous material, in a straight line, and to deliver it in a position to be formed into a continuous sliver, as described.

299. Steam Boilers; Edward Whitely, Boston, Massachusetts.

Claim—The water tubes within the space surrounding the boiler, arranged in the manner set forth.

300. Machine for Splitting Fire-wood; W. L. Williams, City of New York.

Claim—1st, The employment or use of the endless feeding chains, when arranged as shown, or in any suitable way, so as to have the usual rotating movement around their pulleys, and also the lateral movement, for the purpose specified. 2d, The endless feeding chains, in combination with the yielding rollers, for the purpose of permitting the lateral movement of the chains. 3d, The yielding pawls in connexion with the yielding rods, in shafts and spurs, arranged to permit of the yielding of the blocks of wood while being split, as described.

301. Double Seaming Machine; James Wilson, C. Green, and Wm. Wilson, Jr., Wilmington, Delaware.

Claim—The combination of the discs and the burring pulley, the bearing down pulleys, the double burring pulleys, and the finishing pulley, in the manner described.

302. Machine for Corrugating Sheet Metal; James Wilson, C. Green, and Wm. Wilson, Jr., Wilmington, Delaware.

Claim—The arrangement of the upper and lower heads and the forming rollers, together with the rollers which support the cylinders to be corrugated at the requisite angle, as described.

303. Variable Cut-off Gear for Steam Engines; D. A. Woodbury, Rochester, New York.

Claim—The arrangement of the rocker and its variable slide, and the inclined or toggle-like connecting rods, in combination with the eccentric, or its equivalent, and the arms on the valve shafts, as described.

304. Mode of Opening and Closing Farm Gates by Hand; Gilbert Yates, West Dresden, New York.

Claim—The combination of the lever or arms with the connecting arms, vibrating, connecting, and unlatching piece and cords, when arranged and combined with the gate and posts, as set forth.

305. Automatic Fan; George W. Zeigler, Tiffin, Ohio.

Claim—The combination of the levers, S R, supporting the bedstead with the escapement wheel, P, lever, R, pendulum, and fan, together with the parts connecting the same for operating the fan from the weight of the occupant of the bed.

306. Restoring Waste Vulcanized India Rubber; F. Baschnazel, Wenham, Assignor to the Beverly Rubber Co., Beverly, Massachusetts.

Claim—The process described—that is, boiling waste vulcanized rubber in water, after it has been reduced to a finely divided state, for the purpose of restoring the same to a plastic, gummy, or elastic state, fit to be used again in the manufacture of india rubber fabrics and substances.

307. Hydraulic Presses; Thomas Baxter, Assignor to Wm. H. Baxter, Petersburgh, Virginia.

Claim—Making the cylinders of hydraulic presses in a manner described.

308. Needle Wrappers; Richard Bennett, Redditch, England, Assignor to J. F. Milward, City of New York; patented in England, May 7, 1857.

Claim—The employment, in combination with the outer wrapper, of an inner wrapper, with an attached piece through which the needles are stuck, in the manner described. Also, the employment, in combination with such inner wrapper, of a loop secured to the outer wrapper, substantially as specified.

309. Holding Keys for Strap Connexions for Engines; Truman Cook, Assignor to A. T. Smith, Washington City, D. C.

Claim—The notches in the key, as shown, the hole in the gib, the notch at the side of the said hole, the bolt with its peculiarly formed bead, and the combination and arrangement of these parts upon the principle and in the manner set forth.

310. Saw Jointer: Sherman McLean, Royalton, New York, Assignor to the American Trades Company, City of New York.

Claim—The arrangement and adjustment of the file in the tool or file carrier, so constructed that when the flat side of the long arm of the tool is pressed against the side of the saw blade, it will present the file exactly at right-angles to the angular edges of the teeth, and being passed along over them, will square and make uniform their edges, the saw blade being placed, when the instrument is in use, between the long and short arms of the saw-jointer, as described.

311. Mole Plough; H. W. Rowland and E. Forbes, Assignors to selves and Washington Witherow, Newport, Ohio.

Claim—Pivoting the carriage to the beam near its forward end, as represented, and in combination therewith, the curved coulter pivoted to the beam and friction rest, all arranged and operating in the manner set forth.

312. Chamber of Ordnance and other Fire Arms; John P. Schenkl, Worcester, Assignor to self and E. A. Dana, Boston, Massachusetts.

Claim—The combination of an intercepting rod or leader with the secondary barrel or auxiliary charge chamber, and a projectile adapted to the gun or piece of ordnance.

313. Thermostat for Steam Boilers; O. M. Stillman and S. Wilcox, Jr., Westerly, Rhode Island.

Claim—Regulating the flow of the products of combustion to the superheater by the difference in pressure between the superheated steam and that of saturated steam, in the manner described.

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314. Stoves; R. W. Belson, Philadelphia, Pennsylvania.

Claim—The semi-circular heater turning upon the hollow axis near to one side of the heater, arranged and combined with the stove in the manner set forth. Also, combining said heater by means of collar, with the air chamber in rear of the fire-back.

315. Stoves; R. W. Belson, Philadelphia, Pennsylvania.

Claim—The arrangement of the air heater sliding over the oven top and connected with the air passage. Also, making the damper and its shaft hollow.

316. Animal Traps; A. S. Blake, Waterbury, Connecticut.

Claim—A trap, having its spring attached below the jaws, and the spring brought within, or nearly within, the diameter of the jaws.

317. Screw Wrench; Albert D. Briggs, Springfield, Massachusetts.

Claim—The application of the sleeve to the nut and the handle, so as to not only be capable of turning with and rotating the nut, but of moving longitudinally on the handle and with the nut, in accordance with the movement of the movable jaw on the shank.

318. Dishes for Waxing Thread; George A. Brigham, Marlborough, Massachusetts.

Claim—The combination of the guard, the dripper, and the guides, with the two wires, to be placed in the dish to hold the thread.

319. Sugar Mills; John S. Brown and A. C. Greenleaf, Indianapolis, Indiana.

Claim—The combination and arrangement of the rods, levers, and bearings, with the set-screws, when constructed and operated as set forth.

320. Steam Engines; Wm. W. Burgoyne, Washington City, D. C.

Claim—1st. The employment of the following elements in combination, for the accomplishment of the described object, to wit: a water-jacket open to the atmosphere, enclosing the fire chamber, piston chamber, and smoke-stack, a steam evaporating plate forming the crown plate of the fire-box, a supply pump for jetting in the water upon the evaporating plate, and a piston, which is hung or arranged so as to reciprocate in the path of a circle or in a straight line when operated upon by the evaporating steam, and in its movement operate the driving shaft of an engine. 2d, The manner described of making steam between an intensely heated plate, piston, and the isolated or comparatively cool sides of the piston chamber.

321. Marine Governors for Steam Engines; James L. Cathcart, Georgetown, D. C.

Claim—Regulating the supply of steam to marine steam engines by means of a pendulum, arranged and operated substantially as described.

322. Harvesting Machines; George and W. Chamberlain, Olean, New York.

Claim—The combination and arrangement of the gathering fingers and knives with the reel, arms, receiver, and dischargers.

323. Devices for Starting Railroad Cars; David Cumming, Sorrel Horse, Pennsylvania.

Claim—1st, In combination with the ratchet wheels and the ratchet bars, arranged as described. 2d, So arranging the ratchet bars with the sliding frame, to which the power is applied, as that said bars will be capable of slight play, up and down, when in clutch with their wheels, and will run entirely out of contact with said wheels without the aid of other mechanism.

324. Mode of Connecting and Supporting Railroad Rails; M. O. Davidson, City of New York.

Claim—The use of a rail having its lower web cut away for about 15 inches at the ends, in combination with the use of a bridge rail splice, of a form suitable to receive and support securely the stem of the rail after its lower web has been cut away, and of a length of about 30 inches, or of the distance from centre to centre of crop ties at the ends of the rails.

325. Cotton Press; Thomas F. de Bruler, Rockport, Indiana.

Claim—The construction and arrangement of the eccentrically operated gear racks with the connecting rod or yoke. Also, the combination of the said devices with the plunger or follower. Also, the construction, and arrangement, and combination of the traversing pinion with the sliding carriage and driving lever or arms.

326. Mode of Connecting Strung Pearl Jewelry; Henry Dubosq, Philadelphia, Pennsylvania.

Claim—Connecting the mother-of-pearl or plates of other material used to form the foundation on which the pearls are strung.

327. Low Water Alarm for Steam Boilers; Selah Dustin, Detroit, Michigan.

Claim—In combination with a steam cylinder located inside of a steam boiler, and having two openings in it, a float and rod carrying or operating two valves in equilibrio, and having no packed joints, by which means I avoid all undue pressure and friction, and render the float more sensitive to any variation of the height of the water in the boiler, and thus obtain a more reliable indication or signal than by any of the heretofore-essayed plans.

328. Breech-loading Fire Arms; Willard C. Ellis, Springfield, Massachusetts.

Claim—The cere, having the double action of firing the pistol and unlocking the hook. Also, the lever, in this or any other form substantially the same, in combination with the lugs on the hammer or with lugs on the sides of the pistol frame. Further, the cocking of the pistol by the act of breaking down the barrel, in the manner described.

329. Method of Adjusting the Knives of Rotary Cutter Heads for Planing Wood; Benaiah Fitts, Worcester, Massachusetts.

Claim—Placing the bolt, or its equivalent, under the knife, to operate or adjust the knives, as described.

330. Rotary Pumps; Truman Freeman, Jr., Providence, Rhode Island.

Claim—The combination of the pistons with the dogs, arranged for conjoint operation with the cam and pin, in the manner specified.

331. Washing Machine; Lockwood Gail and John H. Gail, West Falls, New York.

Claim—The arrangement of the vertical post and lever with the rubber.

332. SPRINGS FOR RAILROAD CARS AND CARRIAGES; Perry G. Gardiner, City of New York.

Claim—The construction of a spring by confining the ends of the exterior blades in bearings in the ends or heads of a tension bar, without rivets, bolts, hinges, pins, or screws.

333. STEAM-SPADING MACHINES; J. W. Goodell, East Wallingford, Vermont.

Claim—1st, The wheels provided with spades in connexion with the clearers and the rotating plates. 2d, The attaching of the frame which contains the wheels to a traction engine by means of a universal joint, in connexion with the gearing and shaft, whereby the frame and the wheels are allowed to conform to the inequalities of the ground and the working parts driven direct from the engine.

334. SELF-ACTING APPARATUS FOR WORKING RAILWAY BRAKES; Edouard Guerin, Paris, France.

Claim—The forked piece, vertical lever, provided with balance weight, rod and collar, when arranged as set forth. I reserve to myself the right of varying or changing the forms, dimensions, and proportions of accessories and matters employed.

335. SEEDING MACHINES; Stephen R. Hunter, Cortlandt, New York.

Claim—The seed-distributing cylinder with adjustable shell, in combination with two or more seed-boxes or rotary harrow.

336. STEERING WHEEL; David Knowlton, Camden, Maine.

Claim—The metal rim or circle provided with sockets for the wooden arms or spokes of the wheels.

337. LADIES' COLLAR AND CUFFS; William E. Lockwood, Philadelphia, Pennsylvania.

Claim—Embossed cuffs, collars, and other articles of wearing apparel, made of a fabric composed of paper and thin muslin, or its equivalent, pasted together as set forth.

338. WATER METRE; Nathan B. Marsh, Cincinnati, Ohio.

Claim—1st, The combination of the two side or end measuring chambers, middle piece or stationary cylinders, independent reciprocating interior cylinders, having septums, adjusting rods, and valve box, with its valves and passages, the former actuated by the reciprocating interior cylinders, and the latter forming inlet and outlet communications with and from the measuring chambers. 2d, Supporting the reciprocating interior cylinders on projections formed by the extension inwards of the end flanches of the stationary cylinders, and packing said reciprocating cylinders by the gaskets, which make tight the joints of the stationary cylinders with the measuring chambers, said gaskets being cupped or bent internally.

339. MACHINE FOR CORRUGATING SHEET METAL; Richard Montgomery, City of New York.

Claim—The combination of the level wheel and bevel pinions with the sleeve, projections, and fork, with the corrugated rolls, and the device for raising and lowering the corrugated roll, whereby a sheet of metal, once entered between the rolls, can be worked back and forth, and gradually and evenly corrugated at one heat and by one attendant.

340. MODE OF CHILLING RIMS FOR LOCOMOTIVE WHEELS; Hiram W. Moore, Jersey City, New Jersey.

Claim—The hollow chilled rim, whose inner and outer rims are not only united at the sides or ends thereof, but also united throughout the annulus by means of braces extending from one to the other, for the purpose of strengthening the tread of the wheel and preventing it from cracking or breaking in.

341. TREATMENT OF VULCANIZED RUBBER; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—The use of olive oil in compositions of gutta-percha and india rubber, in the manner described.

342. REEFING SAILS; Enoch E. Mulliner, Camden, New Jersey.

Claim—The combination of the divided sail, with reef pennants, roller clews, pulleys, and yard or boom, as described.

[This invention consists in the arrangement of the lower part of a square or fore-and-aft sail as a bonnet, in combination with a yard or boom, and with proper reef pennants attached to the sail in such a manner that the lower part or bonnet can be reefed or furled to the yard either with or without the upper part of the sail and while connected thereto, and when furled to the yard or boom, can be disconnected from the upper part of the sail to prevent chafing while the upper part remains spread. This improvement applied to the topsails of large ships accomplishes everything that is accomplished by the use of double topsails, while dispensing with the weight of the two extra yards required with such a rig.]

343. FASTENING SLATS ON SUGAR CANE BAGASSE CARRIERS, &c.; Charles Neames, New Orleans, Louisiana.

Claim—The arrangement and combination of the two jaws hinged together at L, by means of a hinge pin, as described.

344. RAILS FOR STREET RAILROADS; Samuel Nicolson, Boston, Massachusetts.

Claim—Making each bearer not only with a grooved upper surface, but with a projection or lip at bottom, for the purpose of producing uniformity of strength in the section of the rail and of entering a corresponding groove in the stringer, and supporting the rail and its spikes or bolts against lateral strains.

345. MANUFACTURE OF ELASTIC BELTING; S. T. Parmalee, Edinburgh, Scotland.

Claim—Submitting the belting, while within the heating or vulcanizing chamber, to pressure between the smooth surfaces of an endless metallic band, and one of two revolving metallic cylinders round which the said band passes.

346. SHARPENING THE CALKS OF HORSE-SHOES; A. W. Payne, Morris, New York.

Claim—The rotary burrs or cutters, one or more, in connexion with the bearing plate or plates, placed within a suitable frame or stock, and arranged as set forth.

347. WATER-PROOF LEATHER HOSE; James Punderford, New Haven, Connecticut.

Claim—Riveted leather hose, made with a water-proof lining applied to its inner surface and extending between the joint or lapping where such rivets are inserted.

348. MACHINES FOR RAKING HAY; David Rambler, Union Deposit, Pennsylvania.

Claim—The adjustable side bars, provided with the rake-heads, J J, and teeth, in connexion with the rake-head or shaft, B, provided with teeth, and used with or without the dividers, to operate as set forth.

349. CORN HARVESTERS; Isaac Reamer and Henry Miller, Conrad's Store, Virginia.

Claim—1st, The combination with the vertically adjustable upper guides, of the vertically adjustable reel, for action together. 2d, The reel, constructed with tangentially set tie-bars or guides, in combination with a platform on which the stalks fall parallel with the line of travel. 3d, The combination with the frame,

A, knife, c2, of the under adjustable frame, A'. 4th, The manner of connecting the platform with the frame of the machine, for the purpose set forth. 5th, Providing the platform with a slide back extension board, in the manner set forth. 6th, The arrangement with oblique or diagonal set spring blade or cutter of a fixed obliquely set carrying wheel, in the manner set forth.

350. Stove Polish Mixer and Scraper; John C. Reed, Providence, Rhode Island.

Claim—The combination of the receptacle, scraper, and mixer, when arranged as described.

351. Machine for Laying Hemp around Wire in Making Rope; Jacob Rinek, Easton, Pennsylvania.

Claim—The revolving yoke, with its hollow spindle and one or more rollers, arranged on and turning in the yoke, when the said yoke and its appendages are combined with, and arranged in, respect to the two sets of bobbins containing the strands of hemp, the perforated guide plates, and tube, as set forth.

352. Spring Bed-bottom; Isaac A Sergeant, Springfield, Ohio.

Claim—1st, The arrangement of the stretcher frame and rails, secured and supported as described. 2d, The supporting legs or stays and racks, in the described combination with the frame. 3d, The described arrangement of straps and knobs.

353. Machine for Addressing Newspapers, &c.; George Shuck, Madison, Indiana.

Claim—The combination with the hopper which contains the documents to be addressed, of the sliding gate provided with a heel or step, and operating to close the hopper discharge, and at intervals to open the same in such manner as to permit of a single document being deposited from the pile in the hopper in front of said heel for after traverse with the gate. Also, the combination of the inclined feeding channel, main type channel, and raised discharge channel. Further, in connexion with the feed bolt, the angle lever, or its equivalent, to aid the type in its course from the feed channel to the main channel of the machine. Likewise, the employment of form boxes, for use as described, at either end of the machine. Also, the combination with the traversing type or form of a notice bell, or its equivalent, for operation by the type at intervals. Likewise, the combination with the bolster, operating essentially as described, of the springs for relieving the type from the paper, and holding it on the bolster and type-shifter. And, lastly, the document-discharging fly, when operated by the sliding gate.

354. Cotton Scrapers; Patrick Sharkey, Brownsville, Mississippi.

Claim—1st. Arranging the scrapers, one forward of the other, on guide blocks or runners of different lengths. 2d, The arrangement of a sleigh-runner shaped gauge with the short scraper.

355. Sewing Machines; Thomas Shaw, Philadelphia, Pennsylvania.

I do not claim, broadly, a needle-bar, to which a vertical as well as a horizontal motion is imparted by cams, or their equivalents—but I

Claim—The feed-bar, attached to and carried solely by the spring, operated vertically by the combined action of the rods and the aforesaid spring, and horizontally by the combined action of the independently adjustable screws and the same spring, and regulated by the screw on the stationary bracket.

356. Governor for Regulating the Speed of Steam Engines; Thomas Silver, Philadelphia, Pennsylvania; patented in England, May 23, 1857.

Claim—The combination of a spring with a momentum wheel and adjustable speed-limiting vanes, the whole constructed with the combination of the peculiarly adjusted sectors, pinion, and links, as described.

357. Detective Register for Doors of Railroad Cars; Walter C. Smith, Georgetown, D. C.

Claim—The opening and closing of car doors by means of the latch or key, in combination with the two index or registering wheels.

358. Gas Pipe Cutter; Joseph E. Stanwood, Malden, Massachusetts.

Claim—My pipe or round rod cutter, as provided with a rotary cutting wheel to operate in conjunction with the claw or pipe-rest. Also, the arrangement of the cutting wheel carrier in a recess formed in the claw block, in combination with the arrangement of the adjustable screws and handle rod, with respect to the said recess and cutter wheel carrier.

359. Spring Car Couplings; Frank Steinhart, Dansville, New York.

Claim—1st, The combination of the radial fenders, or their equivalent, with the jaws of the nippers. 2d, Constructing the bolt head with an open back, and also with a longitudinal recess in its back.

360. Machinery for Accumulating and Transmitting Power; Enos Stevens, Barnet, Vermont.

Claim—The endless chain forming the pendant loops, E and C, supported by the wheels, in combination with the weight suspended from a pulley supported by the loop, E, and the weight or guide pulley, and cord.

361. Pump Boxes; Francis Stock and John Stock, San Jose, California.

Claim—The arrangement of the parts, j, k, l, of the box, in connexion with the bolts or rods and valve, as described.

362. Stop-cocks; Thomas Stubblefield, Columbus, Georgia, Assignor to self and Peter Naylor, City of N. Y.

Claim—The combination of the lever, cap, valve stem, and spring, when the cap is provided with a semicircular opening into which fits the semicircular end of lever, for the purpose of forming a tight joint, without packing.

363. Carpet Fastener; James A. Taylor, Cowlesville, New York.

Claim—The hooks and pins, arranged in combination with the carpet.

364. Wrench; George C. Taft, Worcester, Massachusetts.

Claim—The screw-threaded rosette with its hole, in combination with the stationary guide rod, rack, traversing male screw, and sliding jaw, with its female screw.

365. Grinding Mills; George Todd, St. Louis, Missouri.

Claim—Securing the ears of the rim of the stationary stone between a double series of upper and lower springs, whose elasticity is governed and controlled by the series of adjusting screws.

366. Pen-holders; Alfred R. Turner, Malden, Massachusetts.

Claim—A pen-holder, constructed with the cover turning on a pivot or fulcrum, and acted upon by the bent spring. Also, in combination with the above, the sliding piece, as set forth.

367. Lamp Wicks; John B. Wortendyke, Godwinsville, New Jersey.

Claim—A lamp wick composed of strands that have received a preparatory twist in one direction, are then spun in the contrary direction with and coiled upon a thread, and are then twisted together.

368. Machines for Cutting and Folding Wadding and Paper; John Wood, Brooklyn, New York.

Claim—1st, The receiving box, provided with two compartments and fly-boards, connected with racks and with ratchets, actuated by the arms and cam, in connexion with the wheel and adjustable pinion. 2d, Operating the knife gate and plate, by means of the lever provided with the sector racks, which gear into the racks of gate and bar, so that the knife and plate will be actuated or made to perform their respective functions alternately. 3d, The arrangement of gearing, when used in connexion with the lever, for the purpose of operating the several parts automatically.

369. Refrigerator; Abraham Yost, City of New York.

Claim—The combination and arrangement of compartments, dampers, and escape tubes, as set forth.

370. Construction of Railroads; John Young, West Galway, New York.

Claim—Constructing a rail and saddle, whereby I am enabled to securely hold and render solid the joints or ends of rails during the passage of cars. Also, combining with said rail and saddle, the straining arch, key, and strip, for the purpose set forth.

371. Restoring Waste Rubber; Francis Baschnagel, Wenham, Assignor to the Beverly Rubber Co., Beverly, Massachusetts.

Claim—The process of restoring waste vulcanized rubber by reducing the same, by grinding or otherwise, to a finely divided state, and then submitting the same in a suitable vessel to the direct action of steam.

372. Sofa Bedstead; K. Borren, Assignor to Peter Schneider, City of New York.

Claim—1st, Constructing a sofa bedstead with an interior drawer, which may be pulled and united with the sofa seat, so as to form one bed or couch by the application of ways or grooves to the inside of the sofa frame. 2d, The horizontal rods of the sofa frame, in combination with the stay of the interior drawer, for the purpose of more securely guiding the said drawer. 3d, Providing the drawer with two back pins, in the manner and for the purpose described.

373. Steam Valves; Harry H. Evarts, Assignor to self and Phineas E. Merrihew, Chicago, Illinois.

Claim—The arrangement of the ports, cavities, and passages in the valves, in combination with a corresponding arrangement of the ports in the seat, whereby a single valve is made to perform its functions for the two cylinders of the engines, as set forth.

374. Hinge; Levi T. Howell, Burlington, New Jersey, Assignor to self and De Witt C. Taylor, Philadelphia, Pennsylvania.

Claim—The projection on one-half of the hinge, said projection being inclined on one side and abrupt on the other, in combination with the spring bolt and its notch, when the said bolt is so fitted to the other half of the hinge as to have a limited vertical, but no turning movement therein, and when the whole of the parts are arranged for joint action, as set forth.

375. Horse Power; Clark Lane, Assignor to Owens, Lane, Dyer & Co., Hamilton, Ohio.

Claim—The construction and adaptation of the stay rods with the hooked stand plates and racks on the sweep, or their equivalents, in combination.

376. Regulator for Time-keepers; Ralph S. Mershon, Assignor to self and John M. Harper, Philadelphia, Pennsylvania.

Claim—The application to watches, and such time-pieces as have their vibrations governed by a balance and hair spring, of a compound regulator composed of two or more movable segments, constructed and operating as described. Also, the combination of said compound regulator with a greater or lesser scale, the former fixed and the latter movable, but having a fixed indicator, and capable of being operated either in concert with, or independently of, each other, as described.

377. Seeding Machines; George W. Richardson, Grayville, Assignor to self and John P. Williams, White County, Illinois.

Claim—The arrangement of the cam wheel and lever with the seed slide and vibratory bar of the harrow, when the whole are constructed as set forth.

378. Joint for Gas and Water Pipes; James E. Quinn, Assignor to John M. Johnston, Chicago, Illinois.

Claim—The arrangement of the rings on pipe, in combination with the opening in the socket forming the cement chamber, for the purpose of joining pipes air and water-tight, by using cements in place of lead commonly used.

[The invention consists in providing a groove and shoulder at the junction of two sections of pipe or tubing for receiving and confining the cement. The cement is poured into this groove, and against the shoulder, from the outside of the pipe; and when the groove and the hole through which the cement is poured are filled, it is impossible almost to open the joint, and the cement is kept from exposure to the moisture. The use of lead solder is wholly dispensed with.]

379. Bed-bottom; Leonard B. Tinkham, Assignor to self and Charles Ryan, Lawrence, Massachusetts.

Claim—The combination of S-formed springs, arranged so as to receive the movable rivet and retain the slats in place, with bars and stirrups.

380. Egg-beater; John L. Nicolai, Assignor to self, S. E. Knott, and R. F. Farrell, Chicago, Illinois.

Claim—1st, The beaters, arranged with diverging fingers, which are attached to discs, to operate as set forth. 2d, The arrangement of a series of beaters on rotary shafts, so that the several beaters can be operated, as specified.

Extensions.

1. Wooden Bridges; George W. Thayer, Springfield, Massachusetts; patented April 22, 1845; extended April 26, 1859.

Claim—The combination of one or more series of iron screw rods with the suspension posts and cords or string pieces of a truss, in the manner specified. I do not claim the combining with the posts, braces, and strings of a truss, a series of supplementary braces. But I claim the arrangement of such a series of braces upon the outer sides of the truss, and so that they shall extend above and below the cords thereof, and be confined to the truss, as described.

2. Machines for Making Match Splints and Arranging them in the Dipping Frames; Asa Fessenden, Templeton, and Luke S. Knight, Barre, Mass.; patented April 26, 1845; extended April 26, 1859.

Claim—The combination with the series of cutters of the passages leading from the cutters, whether

there be one or more series of said cutters and passages. Also, the combination with the aforesaid cutters and passages of one or more dipping frames, arranged and operating with respect to them, as described. Also, the manner of making the dipping frames in sections of separate pieces or plates. Also, the combination of mechanism by which each of the blocks of wood is held down upon the carriage, and progressively forced forward against the board, the said mechanism being applied to the carriage and board. Also, the combination of machinery by which the dipping frames are progressively moved forward, the said machinery being connected with, and intervening between, the carriage and the said dipping frames.

ADDITIONAL IMPROVEMENTS.

1. SEEDING MACHINES; Charles Cox James, Dayton, Ohio; patented December 15, 1857; additional dated April 5, 1859.

Claim—The arrangement of the stationary roof-like screen, lateral sloping projections, septem, slides, slotted bars, and shoes, with slide and trough; constructed as described, and used in combination with the features covered by my patent of December 15, 1857.

2. ARITHMOMETER FOR ADDITION; Orlando L. Castle, Upper Alton, Illinois; patented November 2, 1858; additional dated April 19, 1859.

I do not claim the use of any particular kind or arrangement of keys. But I

Claim—The combination of the rocker keys and shifting pawl, in any equivalent manner, and for the purposes set forth.

3. MACHINE FOR DRESSING MILL-STONES; Simon W. and R. M. Draper, South Dedham, Mass.; patented May 13, 1856; additional dated April 19, 1859.

Claim—The bed-piece with the cam, bar or lever, and rods, attached, provided with springs, in combination with the frame or carriage, with pick shaft attached, provided with the forked arm, arranged to operate as set forth.

4. MACHINE FOR PACKING WOOL; Charles Carlisle, Woodstock, Vermont; patented October 6, 1857; additional dated April 26, 1859.

Claim—Forming either or both of the leaves of two or more connected longitudinal sections, when the said jointed leaves are so arranged as to operate with the other parts of said machine, in the manner set forth.

5. CORN SHELLERS; Wm. Wells, Boston, Massachusetts; patented January 4, 1859; additional dated April 26, 1859.

Claim—The guide, in combination with the weighted or spring presser, made movable and adjustable with reference to the centre of the disc.

RE-ISSUES.

1. MAKING ILLUMINATING GAS; N. Aubin, Albany, New York; patented January 8, 1856; re-issued April 5, 1859.

Claim—The described process of making gas for heating or illumination, which consists—1st, In mixing materials substantially such as are specified. 2d, In introducing them into a chamber, substantially such as described, located when the process is going on within retort. 3d, In causing the products of distillation of the mixture to pass out of such interior chamber, and then be subjected to a higher degree of heat by passing in contact with the heated surface of the retort itself, substantially as specified, not intending to claim any one step of the process separately, but only the process, substantially as set forth, as a whole.

2. GAS GENERATORS; N. Aubin, Albany, New York; patented Jan. 8, 1856; re-issued April 5, 1859.

Claim—The combination with a gas retort of a removable interior chamber open at bottom, and having such relative shape with regard to the retort, and so located therein, substantially as is specified, and for the purposes set forth; and this I claim irrespective of the location of the opening through which said removable chamber can be introduced or withdrawn, and either with or without an apparatus for introducing steam into the retort.

3. TIGHT JOINTS FOR GAS RETORTS; N. Aubin, Albany, New York; patented January 8, 1856; re-issued April 5, 1859.

Claim—A joint between a gas retort and its cover made by fusible metal contained in a groove into which enters a rim, the joint being such and for the purposes set forth.

4. TUBULAR ELASTIC VALVE; Franklin Peale, Philadelphia, Pennsylvania; patented June 26, 1856; re-issued April 5, 1859.

Claim—1st, The flexible valves described, for the purposes specified. 2d, The method described of adapting the flexible valves to pumps, or other tubes of any kind, whether rigid or elastic, and inserting them therein, in the manner set forth, or in any equivalent mode.

5. SPRING BED-BOTTOM; Hiram Tucker, Cambridgeport, Massachusetts; patented July 3, 1855; improvement added July 9, 1857; re-issued April 5, 1859.

Claim—The described spring bed-bottom, consisting of the combination of the frame, slats, and radial springs, as described.

6. MACHINERY FOR MAKING WOOD SCREWS, &c.; Cullen Whipple, Providence, Rhode Island; Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—In combination with a mandrel which carries chuck or griping jaws, an automatic mechanism for closing said jaws upon the blank, keeping them closed to hold the blank while being dressed, and then opening them to release the dressed blank, arranged and operating in such manner as to leave the mandrel (during the time that the blank is being acted on by the cutter,) free from endwise pressure by the chucking mechanism. Also, in combination of toggle levers carried by the mandrel, a stop or hold-fast, also carried by the mandrel, to lock and hold the toggle levers when pushed beyond a straight line, and griping jaws with shanks having sufficient elasticity to maintain a firm hold of the jaws upon the blank, when the toggle levers have passed a straight line.

7. MACHINERY FOR MAKING WOOD SCREWS, &c.; Cullen Whipple, Providence, Rhode Island, Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—A feeding punch and mechanism for causing it to approach within different distances of the griping

jaws adapted to receiving and holding screw blanks in variable positions and of different lengths, in combination with a suitable tool-holder and cutting tool.

8. Machinery for Making Wood Screws, &c.; Cullen Whipple, Providence, Rhode Island, Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—The spring discharging punch, in combination with the mandrel and griping jaws, when the punch and spring are both carried by the mandrel.

9. Machinery for Making Wood Screws, &c.; Cullen Whipple, Providence, Rhode Island, Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—1st, The feeder composed of a sectional trough with a close bottom and open top, into which the blank drops and arranges itself before a traversing rod, which pushes it into the griping jaws. 2d, The combination of an adjustable automatic feeding punch and a spring-discharging punch, with an intermediate trough, or equivalent means for bringing the blank into line with two punches. 3d, The arrangement of a spring-discharging punch, with its end far enough within the end of the grooves in the griping jaws to leave an opening for admitting the end of a blank and guiding it against the end of the discharging-punch, thereby rendering the checking more certain.

10. Printing Presses; George P. Gordon, City of New York; patented July 13, 1858; re-issued April 12, 1859.

Claim—1st, The combination and arrangement of the feed-table, the fly or pile-board, the platen and bed, with the set or sets of independent revolving nippers or grippers, for the purposes described. 2d, The fly-board with its adjustable gauge or guide, in combination with the grippers or nippers to ensure the even piling of the sheets of paper, or their equivalents, whatever the size of the sheet may be. 3d, The vibrating double cam for throwing off and on the impression. 4th, Two or more distributing rollers, having a lateral motion upon a main distributor, which shall move independent of, and in opposite directions to, each other, and thus alternately cross and re-cross each other's distribution, for the purpose of giving a uniform inking to the form. Also, the two distributions given to the inking rollers upon one cylinder, for each impression (heretofore patented by me), in combination with the rotating reciprocating bed, with the spring extension attached.

11. Automatic Grippers for Carrying Sheets of Paper in Printing Presses; George P. Gordon, City of New York; patented July 13, 1858; re-issued April 12, 1859.

Claim—1st, One or more sets of grippers, nippers, or fingers to revolve independent in themselves upon an axis, for the purpose of carrying the sheets of paper to the place of impression, or for carrying the sheet, after it has received an impression, to its place of deposit upon the pile-board or fly-board, or for either or both of these purposes, thus receiving and piling the sheets of paper in an even and regular heap, by the acts of my automatic grippers or independent revolving nippers, or their equivalents. 2d, The combination of the independent revolving grippers with the vibrating feed-board, or its equivalent. 3d, The combination of the independent revolving grippers with a pile or fly-board, to be used as described, or in some equivalent way. 4th, The combination of the independent revolving grippers with a feed-board and a pile or fly-board, or their equivalents.

12. Harvesters; Thomas D. Burrall, Geneva, New York; patented March 18, 1856; re-issued April 12, 1859.

Claim—1st, The shoe-piece and racks to adjust the height of the outer end of the finger-board. 2d, The shaft, f, passing across the end of, and nearly at right angles to, the shaft, 1, of the main wheel, when fitted in such a manner that its pinion can be thrown into and out of gear with the face wheel.

13. Coffee-roasters; Theodore Heermans, Mitchelsville, Tennessee; patented January 18, 1859; re-issued April 12, 1859.

Claim—1st, The specified arrangement of the plates or shelves. 2d, The combination of a window or windows in a coffee-roaster, with agitating or elevating plates or shelves.

14. Grain and Grass Harvesters; E. B. Forbush, Buffalo, New York; patented July 20, 1852; re-issued July 8, 1856; re-re-issued April 19, 1859.

Claim—1st, The device for adjusting the cutting apparatus, which may be raised or lowered without changing the height of the main frame, in combination with the finger bar either with or without the removable platform. 2d, The combination of the inner projecting ends of the main frame with the adjustable cutting apparatus. 3d, Supporting the clamp and finger bar by means of the slotted iron frames and locking bolts, in combination with the cross-pieces of the main frame. 4th, The mould-board, constructed and arranged in the manner set forth. 5th, Extending or widening out the upper part of the guard finger by the overhanging bars, in combination with the central bar, in the manner specified. 6th, Arranging the three-pronged fingers, above described, so that they mutually brace each other in front of the finger bar, and are also braced and supported at each end of the cutter bar by the projections, in the manner specified. 7th, The raking apparatus, constructed and operating in the manner described. 8th, The movable fulcrum upon which the rake is suspended, and operated in the manner described.

15. Grain and Grass Harvesters; E. B. Forbush, Buffalo, New York; patented March 18, 1856; re-issued April 19, 1859.

Claim—1st, The manner of constructing and uniting the inner rear corner of the main frame, so as to depress or drop the shoe and cutting apparatus, and serve as a continuation of the shoe for treading down the stubble and mown grass, in the manner specified. 2d, The combination of the guide stirrup with the front of the main frame, so as to permit the draft-pole to play above and below the front of the main frame. 3d, Connecting the draft-pole to the machine by the oscillating pendent. 4th, So connecting the draft-pole to the machine, as that the draft shall be from the axle or centre line of the driving and supporting wheel, in connexion with the rear extension of the pole, in the manner specified. 5th, The combination of the extended finger bar with the adjusting shoe and adjustable hinged runner, as described. 6th, The combination of the main frame, draft-pole, guide stirrup, and adjustable shoe, arranged with each other in the manner specified. 7th, The adjusting shoe, constructed and operating in the manner set forth. 8th, The arrangement of the caster wheels with adjustable connecting bars in relation to the finger bar, platform, and frames of the machine, in the manner described.

16. Washing Machine; H. E. Smith, Philadelphia, Pennsylvania; patented October 26, 1858; re-issued April 19, 1859.

Claim—1st, The vessel with its yielding valved diaphragm and the perforated diaphragm, or its equivalent, in combination with a pipe, G, communicating with the vessel at a point above, and the pipe, H, at a point

below the said diaphragm, and both pipes communicating with any suitable heating apparatus. 2d, The reciprocating plunger with its enlarged end constructed with the recess, flanch, and perforations, in combination with the yielding diaphragm, for the purposes specified. 3d, Providing the plunger with an upper enlargement concave on the under side, and arranged in respect to the lower plunger, substantially as set forth.

17. GRAIN HARVESTERS; Thomas D. Burrall, Geneva, New York; patented April 5, 1853; re-issued April 26, 1859.

Claim—The additional apron to convert the usual rear discharge into a side discharge of the cut grain. Also, the combination of the curved supports and the adjustable journal box piece to preserve the relative positions of the cogs in the mitre gearing, and at the same time allow of raising and depressing the driving wheel. Also, the notches in the back corners of each knife to prevent clogging or lodgment of fine grass in the cavities of the guards, said notches effecting a good purpose and not weakening the cutter.

18. GRAIN HARVESTERS; Thomas D. Burrall, Geneva, New York; patented April 5, 1853; re-issued April 26, 1859.

Claim—The location of the raker's seat with regard to the drive-wheel and platform. Also, in combination with a raker's seat, located as described, extending the rear of the platform far enough back to allow the raker from his seat to turn the grain upon the platform, and rake it off in an arc of a circle by a circular sweep or quarter turn movement of his rake.

19. ARRANGEMENT OF BUCKETS OF PADDLE-WHEELS; Mathew A. Crooker, City of New York; patented Oct. 28, 1856; re-issued April 26, 1859.

Claim—Arranging the floats or buckets of a paddle-wheel upon its arms, or the equivalent thereof, whereby the buckets shall be continuously increasing and diminishing their depth in the water as the said wheel revolves.

20. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—Driving the pegs into boots and shoes automatically, by means of a peg-driver operated up and down by a positive mechanical movement, whether impelled by a cam, eccentric, or crank, or other equivalent, substantially as specified.

21. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—The moving of the sole of the shoe along by means of the awl that forms the hole in which the peg is inserted, in combination with the peg-driver, whether the peg-driver be or be not employed to perform the additional function of presenting the peg, whereby each hole made by the awl is brought in succession in line for inserting the peg before the awl is withdrawn.

22. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—Cutting off shoe pegs from a strip of peg wood, or other material, by means of a lateral or side cut, that will cut straight across, when combined with suitable ways in which the strip slides, and machinery for driving the pegs. Also, inclosing the peg by the cutter until it is driven, as specified, by making the cutter, when in position, a part of the guiding tube. Also, the combination of the endless feed with a cutter for severing the pegs in a shoe-pegging machine, as specified.

23. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—Connecting the last with a horizontal slide or plate capable of presenting the shoe or boot, so that the shoe or boot attached thereto may be turned and moved in any direction, in a horizontal or inclined course, in combination with a mechanism which tends constantly to force it upward against a rest or guide, but which will permit it to yield downward, but this combination I claim only when combined with the pegging mechanism described, or any equivalent therefor. And I also claim as an automatic means of moving and guiding the last to present it to the pegging apparatus, in the required line of pegging, the guide groove, guide, and pinion, and curved neck, substantially as described, in combination with the mechanism above described, or the equivalent thereof, which permit the last to be moved in any desired direction, as set forth.

24. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—The combination of the universal movement carriage and lateral awl movement, for properly presenting the shoe to receive the pegs in succession. Also, the combination of the mechanism for the cutting and feeding of the pegs, or any equivalent therefor, with the automatic peg-driver. Also, the combination of the following elements, or their mechanical equivalents, namely, the peg-former, the peg-feeder, the peg-driver, and the mechanism for moving the shoe, described, thus constituting an automatic machine for pegging shoes.

25. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—The pegging of boots and shoes with nails or pegs of drawn wire. Also, driving the pegs by means of the cutting nippers, said nippers cutting off the peg after it is driven, substantially as specified.

26. TAILORS' SHEARS; Rochus Heinisch, Newark, New Jersey; patented July 13, 1858; re-issued April 26 1859.

Claim—The oblique rectilinear slot in the elongated shank of the lower blade, in combination with the fulcrum and a lever connecting with two portions of the shears behind the fulcrum.

27. MACHINE FOR MAKING PAPER BAGS AND ENVELOPES; North American Paper Bag and Envelope Manufacturing Co., Philadelphia, Pennsylvania, Assignees of J. A. Smith, Clinton, and S. E. Pettee, Roxborough, Massachusetts; patented May 1, 1855; re-issued April 26, 1859.

Claim—1st, The bar to relieve the end of the under sheet of the weights of the pile, partially or wholly. 2d, The friction bar to separate the under sheet. 3d, The guide bar in connexion with the bar. 4th, The lifter, to relieve the sheet from the weight of the pile. 5th, The feeding from the bottom of the pile. 6th, The combination of the weight bar, friction bar, guide bar, and lifter, constituting a feeding apparatus. 7th, The jaws to place the paper in position. 8th, In combination with machinery for making bags from paper of any size, we claim a former of the shape and dimensions required by the nature of the work to be done, over or around which the paper is to be folded, for the purpose of producing the bag or bags. 9th, The pasters and side folders. 10th, The combination of the table, the bar, the side folders, and pasters, all constructed as set forth.

28. Sewing Machines; Emeline M. Stedman, Vienna, New Jersey, Executrix of George W. Stedman, deceased; patented December 12, 1854; re-issued April 26, 1859.

Claim—1st. The tube described, receiving thread in the manner specified, and acting in combination with the needle, so that each forms a series of loops, each of which loops receives one and is received by the next one of the other series. 2d, The auxiliary plate carrying the guide for the looping tube, and secured to the bed-plate, so as to be adjustable to any desired position relatively with the needle. 3d, A reciprocating tube, or equivalent device, co-operating with an eye-pointed needle to concatenate or form the stitch, and produce sewing essentially as specified, combining with and receiving its motion from one end of a lever, the fulcrum of which is at or near the bed or table of the machine, while the other end carries the said needle. 4th. Feeding the cloth by means of a needle which is made to pass through the same in a position with respect to its length, diagonal to its line of movement, in combination with a spring to throw the needle into position to feed the cloth the next stitch, and the screw, or its equivalent, to determine and regulate the length of the stitch.

29. Grain and Grass Harvesters; Eliakim B. Forbush, Buffalo, New York; patented April 17, 1855; re-issued April 26, 1859.

Claim—1st, The arrangement and connexion of the rear cross-timber in relation to the main frame, in the manner specified. 2d, The peculiar construction and arrangement of the gear frame in relation to the main frame, driving wheel, and gearing. 3d. The gear key, in combination with the gearing shaft. 4th, The locks in the clamp. 5th, The track clearer, provided with the arms, arranged in relation to each other, and socket-piece, to operate in the manner described. 6th, A recess made in the outside shoe, in the rear of the outside cutter bar. 7th, The second angle at c r, formed by the brace bars of the guard finger.

Designs.

1. Floor Cloth; James Patterson, Elizabeth, New Jersey; dated April 5, 1859.
2. Plates for Cooking Stoves; S. H. Ransom, Albany, New York; dated April 5, 1859.
3. Plates for Stoves; S. H. Ransom, Albany, New York; dated April 5, 1859.
4. Stoves; Garrettson Smith and Henry Brown, Philadelphia, Pennsylvania, Assignors to Hayward, Bartlett & Co., Baltimore, Maryland; dated April 12, 1859.
5. Stoves; G. Smith and H. Brown, Assignors to North, Chase & North, Philadelphia, Pennsylvania; dated April 19, 1859.
6. Cook Stoves; Sherman S. Jewitt and Francis H. Root, Buffalo, New York; dated April 26, 1859.
7. Tea-pot, &c.; G. W. Smith, Hartford, Connecticut; dated April 26, 1859.

MAY 3.

1. Manufacture of White Lead; Fanning Albert, Brooklyn, New York.

Claim—The application of a rotating self-feeding cylinder for the drying of wet carbonate of lead.

2. Alarm Water Gauge; W. R. Andrews and John Oswald, Chicago, Illinois.

Claim—The disc valve, its stem and spring, applied in combination with the enclosing sockets, F and G, the latter of which contains an annular passage communicating with a whistle.

3. Faucets; Silas Barker, Hartford, Connecticut.

Claim—The vertical discharging orifice and the concave end cut-off to the face slide, in the manner set forth.

4. Elevators; Albert Betteley, Boston, Massachusetts.

Claim—1st, The combination of the air reservoir with the movable car or platform of an elevator. 2d, Constructing the base of the car in the parachute form.

5. Door Spring; Amos S. Blake, Waterbury, Connecticut.

Claim—The arrangement and combination of the spring, links, and arms.

6. Manufacture of Watch Cases; James Boss, Philadelphia, Pennsylvania.

Claim—1st. Spinning-up of watch cases by the employment of a mandrel and spinning wheels, constructed in the manner set forth. 2d, Spun plated sheet metal watch cases, constructed as specified.

7. Fastening for Curtains of Carriages, &c.; Wm. Z. W. Chapman, City of New York.

Claim—A curtain knob fastening, constructed so as to be readily opened from the base or on either side of the curtain.

8. Skate Fastening; Chandler Cheney, Milford, Massachusetts.

Claim—Securing the back part of the skate to the boot or shoe, by means of the spring band in connexion with the screws, or their equivalents, in the manner described.

9. Sewing Machines; D. W. Clark, Bridgeport, Connecticut.

Claim—As an improvement on my patent of August 31, 1858, the combination and arrangement of mechanism for the purpose of controlling the feed wheel, in the manner set forth.

10. Water Cask Life-boat; Wm. N. Clark, Chester, Connecticut.

Claim—1st, Making the staves upon the lower side of the water cask more curved than those are upon the upper side, in order to give the life-boat a proper bearing and greater stability in the water. 2d, The ballast floor, water tank, and hatch, when they are used in connexion with the water cask and life-boat.

11. Smoke-stack for Locomotive Engine Houses; Henry Clayton, Tamaque, Pennsylvania.

Claim—The arrangement and combination with the smoke pipes of locomotive engines of a sliding tube, flue, and stack, as described.

[A series of flues communicate with a common stack at the centre of the building, the flues being provided each with a sliding or adjustable cap and tube, so arranged that each cap may be lowered over the top of a smoke pipe of a locomotive to convey the smoke therefrom into the stack, the tubes of the caps acting as valves as well as means of communication with the stack, so that when the caps are raised the flue of each elevated cap will be cut off below with the external air, and thereby prevented from injuring the draft of any of the flues in use.]

12. Skate Fastening; John H. Coe and Wm. B. Sniffen, Stratford, Connecticut.

Claim—1st, The employment of the curved adjustable slotted bars at the front of the foot or base plate, combined in relation to each other and secured together and to the said base or foot-plate, in position to correspond with the length of the foot and form of the front part of the same. 2d, The combination of the right and left screw and the clamps, with the heel part of the skate frame, so that both clamps are simultaneously moved. 3d, The combination of a hinged handle with the screw which operates the clamps, so that after the skate is fastened to the foot, the handle may be folded out of the way of the ice.

13. Bomb Lance; Paschel B. Comins, San Francisco, California.

Claim—The employment of wings formed of a flexible material in connexion with metal springs, when so arranged as to be folded on the cylinder (for containing the powder), between the head and wad, in the manner set forth.

14. Apparatus for Generating Gas; Mathias P. Coons, Brooklyn, New York.

Claim—The form and mode of arrangement of the retorts, as specified, for the purpose of combining a series of gas-generating retorts, as combined, for extending or diminishing its capacity of generating gas indefinitely. Also, the combination of a diaphragm surrounding a condensing chamber and escape pipe.

15. Cooking Stoves; Joseph Cox, Philadelphia, Pennsylvania.

Claim—The chamber above the top oven plate, communicating with the external air and fire chamber, whereby there is effected the double function of aiding combustion and equalizing the temperature of the upper portion of the oven.

16. Variable Cut-off for Steam Engines; Alexander Crumbie and Russell D. Briggs, Brooklyn, New York.

Claim—The arrangement and combination of the toggle rods, slide, rockers, stems, and lifters, as described.

17. Tobacco Press; Edward and Wm. B. Cunningham, Powhatan Court House, Virginia.

Claim—Producing an improved hand press which is especially calculated to aid in compressing bunches of leaf tobacco into the proper shape for packing or "prizing;" the said press being composed of a narrow open box which has a fulcrum piece and a false bottom combined therewith, and a removable lever adapted thereto.

18. Lamps; Michael A. Dietz, Brooklyn, New York.

Claim—Securing or connecting the deflector to and into the chimney band by means of a groove, as described.

19. Lock for Piano-fortes; P. F. Dodge, West Cambridge, Massachusetts.

Claim—Actuating the bolt by means of the arm, of the tumbler, and the recess in the bolt.

20. Piano-fortes; Spencer B. Driggs, City of New York.

Claim—So arranging and applying the sound board and strings, and so constructing and applying the bridge or bridges of a piano-forte, that the depths of the bridge or bridges at the bearing points of the several strings, and the distances of the several strings from the board, are all in the same proportion, or thereabouts, to the length of string.

21. Machine for Filing Gin Saws; James W. Elliott, Prattville, Alabama.

Claim—1st, Making said table adjustable at both ends. 2d, The standard, with the adjustable post and slotted bar for supporting the cylinder of saws. 3d, Making the way adjustable, both perpendicularly and laterally, for bringing the frame to any desired position. 4th, The use of the clamp screw, in combination with the way for holding the frame in position. 5th, A pawl held in place by the coiled spring and operated by the connecting rod, rock shaft, and levers or arms for rotating the saws. 6th, The friction plates for holding and moving the saws, said plates being arranged as described. 7th, The adjustability of the guides, for the purpose of pressing the files more or less against the saws, at pleasure.

22. Forming Curved Electrotype Plates; Wm. H. Elliott, Plattsburg, New York.

Claim—1st, The employment of ledges, in combination with the form, for the purpose of holding a compound flexible impression sheet or type matrix in the required form, with or without screws. 2d, The employment of curved edges, in combination with the form, when said edges are so arranged in relation to said form that the edges of the compound impression sheet shall be held firmly between them, for the purpose of holding said impression sheet or type matrix in a cylindrical form. 3d, The employment of air escapes, in combination with form, box, and the flexible impression sheet, so as to provide for the escape of air from between the said impression sheet and form. 4th, The combination and arrangement of the concave form with the adjustable wires, for the purpose of holding the impression sheet in contact with the concave side of said form. 5th, The employment of a curved impression sheet of sufficient elasticity that it may be straightened out while the matrix is being formed by the type, and then spring up again by its own power to the form required, in combination with the curved form, when used for the construction of a curved type matrix.

23. Shingle Machine; Wm. Kirkpatrick, Lancaster, Pennsylvania.

Claim—1st, The added plate, constructed as described, and when acting in combination with the wrought iron piece and spring. 2d, The guide piece, as arranged and for the purpose specified. 3d, The combination of the rod with the pieces, g g and a a, by means of which the frow is enabled to accommodate itself to the winding grain of the timber.

24. Handle for Cutlery; J. W. Gardner, Shelburne Falls, Massachusetts.

Claim—Attaching the handle to the knife, or other implements or tool, by means of a tang provided with a cylindrical projection and bolsters, the tang and projections being fitted in a longitudinal kerf or cut and hole in the handle, the bolster bearing on the end thereof, and the tang secured in the handle by a rivet.

25. Machine for Cleaning Grain; T. G. Gleason, Rochester, New York.

Claim—The arrangement of the screens, vibrating longitudinally with the fan, removable apron, and detachable smut cleaner.

26. Valve Gear for Steam Engines; Thomas Hawkins, Mobile, Alabama.

Claim—The combination of the bearing and suspending plates, one on the toe and the other on the lifter, with a self-acting (or pendulum) catch for the purpose of holding open the steam valve to any desired point of the stroke.

27. Wheelwrights' Machine; T. L. Hawkins, Sturgeon, Missouri.

Claim—The arrangement of the several parts, as described.

28. LADIES' HOOP SKIRTS; John Holmes, Boston, Massachusetts.

Claim—1st, Constructing a skirt of "knotted" or "network," and this I claim whether the meshes on the front and back of the skirt are alike or not. 2d, Enlarging the rear upper portion of a skirt, formed by a series of meshes to form the bishop shape, by increasing the relative size or number of meshes on the rear upper portion thereof, as compared with those in the same course on the front of the skirt. 3d, The horizontal bustle-supporting spring, in combination with the compressed tape and the upper part of the skirt. 4th, The combination of the "netted skirt" with the hoops, spring, compressing tape, and waistband.

29. HAIR CRIMPER; Ellwood Ivins, Waterbury, Connecticut.

Claim—A hair crimp, composed of a fork and clasp, made as described.

30. EGG-BEATER; S. F. Jones, St. Paul, Indiana.

Claim—An egg-beater having a cup, shaft, strap, tube, slotted bar, cords, attached to shaft, and to adjusting screws in bar.

31. SKATES; Uriel Josephs, Quincy, Massachusetts.

Claim—1st, The combination of the braces or struts with the plates, either with or without the screw. 2d, The combination of the bar with the runner.

32. MEASURING FAUCETS; Ira Kinman, Freeport, Illinois.

Claim—1st, The employment of an endless screw, or its equivalent, in combination with the rotating slide and eccentric chamber. 2d, The register wheel and index hand, in combination with the stop, when the same is operated by the stem of the endless screw, so as to indicate the quantity of liquor drawn through the faucet.

33. WINDLASS; David Knowton, Camden, Maine.

Claim—The winch shaft provided with barrels and connected to the windlass by gears, and so arranged that the windlass may be worked by the winch shaft, or the winch shaft and barrels may be worked independent of the windlass.

34. STEAM BOILERS; L. Lefebre, Donaldsonville, Louisiana.

Claim—The longitudinally fluted boiler, braced as described, in combination with the conformable under surface of the exterior flue.

35. PUMPS; A. W. Lloyd, Otis, Massachusetts.

Claim—The arrangement and combination of the side tube, pipe, valve, and piston, as described.
[The invention consists in the use of a hollow piston, provided with a valve and fitted within a proper cylinder, an air-chamber being connected with the cylinder, and also a side water passage.]

36. GRINDING MILLS; J. C. Lyons, Auburn, and H. F. Philips, Seneca Falls, New York.

Claim—The described arrangement and combination of the grinding cone and the corn cracker, when the former is arranged on a shaft which receives a longitudinal motion by means of a hand wheel, and from which motion is conveyed to the corn cracker by means of wheels.

37. HARVESTING MACHINE; Henry Marcellus, Amsterdam, New York.

Claim—The corrugated finger bar cast with the cutting projections, in combination with the detachable fingers, constructed in the manner specified.

38. ROTARY ENGINE; Charles Miller, Belleville, Illinois.

Claim—All the parts specified, in combination, being and constituting a rotary steam engine, as asked for in my petition.

39. LOCOMOTIVE MACHINE FOR PROPELLING PLOUGHS, &c.; Wm. P. Miller, Marysville, California.

Claim—The combination of the endless chain or track with the leading and driving wheels and supporting tracks.

40. MODE OF ATTACHING HARNESS BREECHING TO WAGON THILLS; Aaron Parker, Coventry, New York.

Claim—The mode of attaching the hold-back straps to thills of vehicles, by having a metal ring to slide under a spring snap, in such manner that it will unfasten of itself when the traces are unhitched.

41. VULCANIZING CAOUTCHOUC; D. D. Parmelee, City of New York.

Claim—1st, The method described of treating caoutchouc, gutta-percha, and their compounds, by employing agents in an aeriform or gaseous state, combined with a solvent in a liquid state. 2d, In combination with a solution prepared in the manner specified, to operate on caoutchouc, gutta-percha, or their compounds, preparing the said caoutchouc, gutta-percha, or their compounds, by blending or incorporating therewith sulphur. 3d, Dissolving sulphur in the proportions set forth, or thereabouts, in the solution, prepared as specified, when the same is used in combination with rubber, gutta-percha, or their compounds, previously free from sulphur.

42. CEMENTS; Nelson Parmeter, Gardner, Massachusetts.

Claim—An improved fire-proof cement, composed of said ingredients, in the proportions and in the manner set forth.

43. WRENCH FOR GAS FITTERS; G. P. Phillips, Albany, New York.

Claim—The jaw, arranged to slide, so as to wedge, gripe, or tighten and hold the article to be turned. Also, the nut, K, arranged to slide freely on the bar, and so that it may be locked to the bar, when desired, in combination with the bar. And in combination with the nut, the tightening nut, I, arranged as described.

44. ADJUSTABLE PILE-DRIVER; Thomas Place, Alfred Centre, New York.

Claim—1st, Attaching the frame to the axles by means of the bolt, and rack plate, and guides, to admit the lateral adjustment of the monkey guides. 2d, Screwing the monkey guides in the frame, by means of the universal joint and the sliding joint, arranged with the lever and rack catch, or their equivalents, to admit of the lateral inclining of the guides, as well as the forward and backward movement of the same. 3d, The combination of the frame and guides, when constructed and arranged to operate conjointly, and to admit of the adjustment, as described. 4th, The arrangement of the button or stop, levers, and catch, automatically releasing the shaft from the windlass.

45. LATCH HINGES; John Plant, Washington City, D. C.

Claim—The hinges, when provided with projections and latch, and when constructed as set forth.

46. COTTON PRESSES; H. W. Randle, Burnsville, Alabama.

Claim—The vertical screw shaft, as described, in combination with the levers, cords, and the follower.

47. REVOLVING FIRE ARMS; Joseph Rider, Newark, Ohio.

Claim—1st, The cocking-dog with its notches, applied in combination with the hammer and trigger, and with a stationary stop to effect the cocking of the hammer and firing. 2d, In combination with the above, providing the same cocking dog with a notch in its extremity to be operated upon by a tooth on the trigger, to operate the piece entirely by the trigger for rapidly repeated firing without cocking. 3d, Combining the locking lever with the cocking-dog, by means of a tooth upon the lever and a tooth upon the dog, the tooth being formed to operate as specified. 4th. The construction and application of the trigger guard, in combination with the locking levers, to serve three purposes, viz: as the guard, as the lever for operating the rammer, and as the spring for operating the locking lever, or its equivalent.

48. CIDER MILLS; Joseph Rosecrans, Avoca, New York.

Claim—The arrangement of the cutting cylinder and the tearing cylinder within the hopper, the one acting upon a plane and the other upon a curved surface, and the tearing cylinder so geared as to have rapid rotation as regards the rotation of the cutting cylinder. 2d, The arrangement of the grinding cylinders and pressing cylinders with the endless apron, chute, and hopper, when they are geared, as set forth.

49. MAIL BAGS; Washington Ruddach, Baltimore, Maryland.

Claim—The arrangement of the jointed plates, staples, jointed slide, with projection, when applied to bags with riveted and stitched seams.

50. PUNCHING AND STAMPING PRESS; Stephen P. Ruggles, Boston, Massachusetts.

Claim—So combining in a press for punching, stamping, &c., a coarse and fine threaded screw, with the power that drives the press, as that the coarse screw may be in action when speed or motion is required, and the fine screw when power is required; the former ceasing its action and the latter coming into action according to the resistance against the punch or die.

51. CORN AND COB CUTTER; Samuel B. Shinn, Philadelphia, Pennsylvania.

Claim—The peculiar construction of the cutter head, with or without the combination of the knives and crushers, arranged in the manner set forth.

52. WASHING MACHINE; Olloff Shostrom, Altona, Illinois.

Claim—The combination and arrangement of slats, levers, serrated plates, with rods, false bottom, endless apron, lever, and pawl.

53. COFFEE-ROASTERS; Jonathan P. Simmons, Baldwinsville, New York.
Claim—The combination of the revolving ring with the spherical case, as specified.

54. SPINNING FLYERS; D. F. Smith, Manchester, New Hampshire.

Claim—The construction of the arm and stem of the compresser of one piece and the stop of a separated piece, so applied as to confine the stem in the ears on the flyer-tube.

55. HARVESTING MACHINES; Joseph D. Smith, Lancaster, Ohio.

Claim—1st, The arrangement of the mechanism for adjusting the cutting apparatus, consisting of the rack bars, hinged to the cutting apparatus shaft provided with pinions, and ratchet wheel and pawl, when employed in combination with the adjustable wheel, in the manner specified. 2d, The employment of the ball journals of the reel shaft, in combination with the off-side horizontally turning timber of the reel frame. 3d, The combination of the secondary standard, arranged on the sickle bar with the hinged laterally adjustable brace, in the manner described. 4th, The combination with the upward curved edge of the sickle bar, of the overhanging upper lip and under back extension flanch of the sickle guard or tooth. 5th, The spring catch arranged on the sickle back, in combination with the stop-notch formed in the pitman, for the purpose of fastening the sickle or cutter-back to the pitman.

56. ROTARY PLANING MACHINES; Wm. H. Smith, Newport, Rhode Island.

Claim—The combination of the rotating cutter head with the central adjustable bearing plate, arranged as set forth.

57. PORTABLE HORSE POWERS; George W. Swift, Oxford, Mississippi.

Claim—The arrangement of band wheel, shafts, idlers, roller, and cord or chain.

58. MACHINE FOR CUTTING WOODEN CURVED MOULDINGS; Isaac P. Tice, Baltimore, Maryland.

Claim—The adjustable bed formed of the blocks in connexion with the flexible guide plate, rotary cutter head, and the feed or pressure rollers, or their equivalents.

59. SIGNALS FOR FIREMEN; Hezekiah D. Treadwell, Elmira, New York.

Claim—The combination of the catch plates and conical stops, or their equivalents, on the cords, working through a series of holes in the catch plates.

60. WATER WHEELS; Wm. Walker, Pontiac, Michigan.

Claim—1st, The employment or use of the adjustable plates attached to the inner posts of the plates, e, of the buckets. 2d, Providing the buckets with adjustable plates to prevent injury to the buckets by the entrance into the scroll of hard foreign substances.

[This invention relates to an improvement in horizontal centre-discharge water wheels, and consists, first, in having the front or outer parts of the buckets made movable or adjustable in such a way that in case of stones, sticks, or foreign substances of any kind entering the scroll, the buckets will be allowed to yield or give, and be prevented from being broken. The invention consists, secondly, in the employment of a series of adjustable plates or stops, applied to the wheel in such a manner that the issues or discharge orifices between the buckets may be enlarged or contracted as circumstances may require.]

61. LAMP SHADES; Charles and Aaron C. Wilhelm, Philadelphia, Pennsylvania.

Claim—The combination of the metallic shade with the paper pictures between the sheets of mica.

62. METALLIC LATHE; Wm. E. Worthen, City of New York.

Claim—A corrugated pierced sheet of metal, substantially such as specified, either with or without rods or tubes passed through the apertures.

63. HARVESTING MACHINES; W. A. Wood, Hoosick Falls, New York.

Claim—Effecting an oblique delivery of the cut grain from the platform where it falls, by a series of carrying belts of different lengths.

64. MACHINE FOR MAKING PEARL BARLEY; August Wulze, St. Louis, Missouri.

Claim—The arrangement and combination of the frame or wheel, H, pinions, t and u, and wheel, L, with each other and with the pulleys, as set forth.

65. AIR ENGINE; Stephen Wilcox, Jr., Westerly, Rhode Island.

Claim—1st. The arrangement of the changing cylinder, B. and working cylinder, D. and the valve or valves by which piston, b, is made both to change the air from the cold to the hot end of the cylinder, and to receive a fresh volume of air from the next stroke, with the advantages set forth. 2d, Automatically regulating the temperature of the interior of the heating surfaces by the employment of the parts. H and L, arranged relatively to the heating surfaces of the cylinders, A and B, and to the damper, or its equivalent, in the flue. 3d. Giving the regenerator an increasing area from the cold to the hot side. 4th, Working the single valve, in combination with the two pistons, a and b, as described, so as to thereby accomplish the threefold purpose of induction, eduction, and equilibrium valve.

66. AMALGAMATOR: F. B. Cavanah, Assignor to self and R. H. Northrop, Pioneer Mills, North Carolina, and W. A. McCulloch and E. C. Aiken, Albany, New York.

Claim—The arrangement and combination of the elevated quicksilver channels near the rim of the oscillating amalgamating pan.

[This machine is more particularly intended for the washing and amalgamation of gold found in quartz rock, but also applicable to the extraction, by washing and amalgamation, of gold and other metals from various foreign substances with which they may be found incorporated in nature. It consists of a circular pan containing a peculiarly constructed series of concentric channels, arranged to oscillate about a vertical axis, and furnished with a central funnel and distributing cone to cause the pulverized metalliferous matter from which the gold or other metal is to be extracted, to be fed with a suitable amount of water all round the outermost channel, from whence it has to make its way from one to another of the several channels over and among quicksilver, which is contained in certain or all of the channels, to a discharging pipe or orifice at or near the centre of the vessel.]

67. CEMENTS FOR ROOFING; Nathan A. Dyar, Medford, Assignor to self and Rufus Kendrick, Cambridgeport, Massachusetts.

Claim—A central layer or web of cloth, or its equivalent, covered on both sides with adhering layers of water-proofing, the outward side of one of which is covered with a layer of paper fixed thereto by contact with the water-proofing while it is in a warm and plastic state, while upon, and embedded in, the outward side of the other layer of water-proofing, while in the state just described, is a layer of sand, or its equivalent, forming the uppermost or weather surface of the article.

68. MECHANISM FOR OPERATING STEAM OR AIR SIGNAL WHISTLES; Moses G. Farmer, Salem, Assignor to Wm. F. Channing, Boston, Massachusetts.

Claim—The combination of an electro-magnetic escapement with the mechanism described for operating a steam or air whistle.

69. REED ORGANS; Theophile Auguste Rousseau, Belleville (near Paris), Assignor to Edouard Alexandre, Paris, France; patented in France, January 23, 1857.

Claim—1st, The arrangement of the wind chambers and registers or stops, in combination with the reeds, whereby each key operates as many valves as there are stops in the instrument, but only those notes are caused to sound where the register is open, thus rendering the fingering easy whatever may be the number of stops. 2d, The arrangement of the valves and knee-pieces, in the manner specified. 3d, The manner specified of arranging the various plans or stories of the instrument, and hinging the same together for affording access to the different parts.

70. VALVES FOR STEAM ENGINES; Wm. Shepherd, Jr., Assignor to Thomas Holmes and Van Wyck Foster, Brooklyn, Eastern District, New York.

I do not claim the prevention of the slamming of the valve, without reference to the means by which such result is accomplished; neither do I claim, broadly, the interposition of a steam cushion to check the motion of the valve. But I

Claim—The combination of the steam ports with the cover operated by the action of the valve, substantially as described.

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71. CULTIVATORS; Milton Alden, Auburn, New York.

Claim—The described arrangement and combination of the adjustable shares, the frame, and the raised thills, which are made out of one piece with the handles.

72. MACHINE FOR SAWING SHINGLES; Wm. H. Auld, Brighton, Iowa.

Claim—The adjustable saws in connexion with the reciprocating bolt carriage. Also, the arrangement of the notched racks, gearing, weight, pins, levers, and bars, attached to the bolt carriage, in connexion with the stops for automatically feeding the bolt to the saws.

73. MACHINES FOR SEPARATING STONES, &c., FROM CLAY; Charles Bamberg and Roman Blaser, Chicago, Ill.

Claim—The conical rotating screen, in connexion with the separator placed within suitable boxes.

[A conical screen of knives is connected with a separator, and placed in a suitable box provided with discharge spouts, and this forms the invention, the object of which is to separate large gravel, stones, and all coarse foreign substances from clay preparatory to its manufacture into bricks, pottery, &c.]

74. SOLE-CUTTING MACHINES; Jacob Batchelder, Salem, Massachusetts.

Claim—1st. The particular and relative arrangement of the levers with the cranks for giving the required motions to the cutting knives. 2d, The use and arrangement of the adjustable and intermediate gauge board, whereby each alternate sole can be cut of equal or unequal width.

75. STRAW CUTTERS; John Bean and Benjamin Wright, Hudson, Michigan.

Claim—The arrangement and combination of the knife, lever, and rock shaft.

76. RAILROADS FOR STREETS; S. A. Beers, Brooklyn, New York.

Claim—The construction of upright self-sustaining rails of cast or other iron, with car and carriage track combined, to be laid in public streets and highways, and for no other purpose.

77. BRICK MACHINES; H. T. Beggs, Liberty, and James Allen, Lynchburg, Virginia.

Claim—The combination of the bevel wheel cast with the cells therein, for the reception of the moulds, the plungers, with the friction rollers and axles, circular inclined plane ring, guard, and top plate.

78. SKATE FASTENING; Edward Behr, City of New York.

Claim—Drawing or tightening the toe and heel straps of the skate around the foot of the wearer, by means of the screw rods and nuts fitted in the stock, one end of the straps being attached to the stock, and the opposite end to the nuts by means of the cords, or their equivalents.

79. SHIPS' STOP BLOCKS; A. J. Bentley and Wm. H. Allen, City of New York.

Claim—The arrangement of rollers and wedges.

[In this block the rope runs between wedges provided with rollers, and the moment the wedges are released, they are pressed together by two helical springs, and the more the rope is pulled, the faster it is held between the edges.]

80. CORN PLANTERS; L. F. Bingham and N. O. Pierce, Chicago, Illinois.

Claim—The arrangement of the rotating planter, square tube, beam, lever, "spat down" or leveler, and scraper.

81. CORN PLANTERS; A. W. Brinkerhoff, Upper Sandusky, Ohio.

Claim—The adjustable coverer and opener, in combination with lever, L, the weighted lever, A, operating the rollers and rod.

82. MANUFACTURE OF PAPER AND PAPER PULP; James Brown, London, England; patented in England, June 10, 1857.

Claim—The treatment of paper and paper material with glycerine, to be employed for printing or other purposes.

83. PLOUGHS; C. M. Bryan, Wright City, Missouri.

Claim—Attaching the mould-board by means of the bolts passing through cleets at the inner side of the mould-board, and into the landside and handle, the bolts and the brace bar.

84. MACHINES FOR LOADING HAY; S. V. Essick, Moultrie, Ohio.

Claim—The adjustable frame, the rake, the rakers, and the conveyors.

85. MACHINES FOR SEWING FERTILIZERS; T. J. Burrall, Geneva, New York.

Claim—The arrangement of the revolving cylinder, divisions, and adjustable perforated slides.

86. MACHINES FOR SPLITTING LEATHER; D. H. Chamberlain, West Roxbury, Massachusetts.

Claim—Inclosing the cutting blade within an external casing throughout its entire length.

87. CONVERTIBLE CARRIAGE SHAFTS; R. J. Colvin, Lancaster, Pennsylvania.

Claim—1st, The attachment of removable shafts by means of adjustable braces and the hinged caps of the pole crab. 2d, The curved or segment bars forming a transverse horizontal slot in which the shafts are supported at their rear end, both when separated in the ordinary way, and when united together as a pole. 3d, The hinged and pivoted thill attachment for accommodating the width of the same to the different positions of the clips upon the axle.

88. BUTTERFLY VALVES; Nathan Cope and Wm. Hodgson, Cincinnati, Ohio.

Claim—The arrangement and combination of the curved slotted plate, valve-box, stops, and slotted valve lever.

89. GRAIN SEPARATORS; J. B. Crist, Evansville, Indiana.

Claim—The arrangement of the blast passage, fan, screen, and riddle, with chute attached, placed within the case or box, and in relation with the spouts or discharge passages.

90. PLOUGHS; E. Davidson, Batesville, Arkansas.

Claim—The combination of the bar, stirrup, rod, with the adjustable supplemental landside, F, share, G, and the stationary share, E, and landside, C.

91. FENCE POST; H. T. Dewey, Sandusky, Ohio.

Claim—The combination of the ribbed post and horizontal flanch plate, when jointed to each other.

92. CULTIVATORS; Wm. C. Doss, Lavacca, Texas.

Claim—The arrangement of the triangular frame of shares, with mould-boards that may be taken off at pleasure, scraper, and cultivators.

93. FURNACES FOR HEATING BUILDINGS; B. W. Dunklee, Boston, Massachusetts.

Claim—Combining with the fire-pot and its dome one or more gas-circulating pipes, arranged with respect to the same, and in the hot air chamber of the case. Also, the arrangement of the hot air discharge pipes, and the wings of the arch of the fire dome. Also, in connexion with air register to the front of the ash-pit, an air pipe, carried through the air chamber and into the rear part of the ash-pit. Also, the combination and arrangement of the hot valve and the plate or door with the flue, the pipe, and the opening.

94. METHOD OF COMPENSATING FOR EXPANSION AND CONTRACTION OF METALLIC FENCES; Lewis Eikenberry, Easton, Pennsylvania.

Claim—The method of making provision for expansion and contraction in an iron lattice or other open work fence.

95. STRAW CUTTERS; Stephen Elliott, Richmond, Indiana.

Claim—The arrangement of boards, E, cross-piece, rods, J and G, and lever, H, with boards, B and D, canvas, C, rods, R and S, and lever, Q.

96. SMOOTHING IRON; Andrew Ellison, Boston, Massachusetts.

Claim—Attaching the handle plate to the separate heater or block, by means of the guide and slot, the angular recess and lips, and the latching devices.

97. METHOD OF STRAPPING WOOD IN BENDING; John L. Field, Syracuse, New York.

Claim—The method for connecting metallic straps for bending timber, when the parts are so arranged as to operate in connexion with the forming frames.

98. SEED PLANTERS; D. S. Fisher, Mauckport, Indiana.

Claim—The combination and arrangement of the spring hoe, adjustable spring roller, with the seeding and regulating apparatus.

99. HARROWS; J. H. French, Syracuse, New York.

Claim—1st, The combination and arrangement of three triangular harrows, in such manner as to form

one triple triangular harrow, by connecting the angles with flexible joints or couplings, which admit of the free vibration of the parts, and their ready adaptation to the inequalities of the ground. 2d, Constructing triangular harrows of metallic bars or flat strips of metal, by folding over the same at the angles, in such a manner that the draft strain of the teeth upon one side, shall counteract that upon the other, and forming the couplings at the same operation, by folding in links or hooks at the angles, no bolts being required to secure them in consequence of the self-bracing of the parts.

100. Corn Planters; R. B. Gilbert, Sutherland Springs, Texas.

Claim—The arrangement of the share, coverers, conductor, cylinder, and hopper, wheel, and scraper, for joint operation.

101. Mail Bags; Richard Gornall, Baltimore, Maryland.

Claim—The employment with a mail bag, constructed with a socket and furnished with a lock or other safe fastening of the plates, which terminate in nearly complete tubes, and with the jointed rod or bolt, provided with a hasp or other similar attachment.

102. Rat Traps; Henry Gortner, Irville, Ohio.

Claim—The rotating discs connected by the plates, b b, in connexion with the treadle platform, plates, c c, and bar, d, and the supplemental platform, the whole being fitted to the box.

103. Mechanism by which Employees Register their Time; Benjamin T. Harris, Brooklyn, New York.

Claim—1st, The manner of mounting the cylinder on the spring barrel, and with the connecting coupling. 2d, The binding plate, fitted and acting to retain the ends of the paper to the cylinder. 3d, The arrangement and manner of constructing the slides and impression point. 4th, The rollers and their pawls, in connexion with the slides and openings in the front plate.

104. Corn Planters; Samuel E. Hartwell, City of New York.

Claim—The arrangement of the slide, shoe, and hoe, connecting and acting in the manner as specified.

105. Seeding Machines; Samuel Henry, Chenoa, Illinois.

Claim—The slide bar or seed-distributor, with slide fitted therein and placed relatively with the seed-box.

106. Harvesting Machine; Moses G. Hubbard, Penn Yan, New York.

Claim—The conformation of the intermediate fingers of a reaping and mowing machine, having a conical form with a straight outline from point to heel, so as to present a straight gradual taper on the underside as well as above. Also, the safety flanch for securing the pitman connexion.

107. Machines for Breaking Coal; Charles W. Kennedy and Richard T. Brown, Williamsburg, New York.

Claim—The arrangement and combination of the polygonal spiked drum, spiked crushing plate, and spiked clearing plate.

108. Railroad Car Brakes; Lewis Kirk, Reading, Pennsylvania.

Claim—1st, The arrangement of the hand-wheel and the rod, in combination with the pump, so that by depressing the rod the pump is placed in working order, and that the same can be operated by means of the hand wheel. 2d, The arrangement of the spring catch which is attached to the piston rod of one of the pump cylinders, in combination with the bell crank, or its equivalent, which is operated by means of an eccentric. 3d, Arranging the coupling on a rod in such relation to the spring catch and the cock, that by exercising a pressure on the coupling, the rod is turned sufficiently to open the cock, and to depress the spring catch.

109. Mail Bags; Thomas J. Lamdin, Baltimore, Maryland.

Claim—The placing of the staples or buckles on the flap of the bag or pouch, so that when the flap is turned down, said staples or buckets will pass through the grummets. Also, the manner of forming the seams of the bag or pouch, so that they cannot be cut open and re-sewn from the outside of the back without instant detection on looking at the seam, as its whole character must be changed in any such attempt or effort.

110. Apparatus for Conducting Water to Cisterns; Jabez Lewis, New Orleans, Louisiana.

Claim—Making the change in openings from the box, or its equivalent, by the employment of a weight containing water supplied from a roof, when the weight can lose the water it contained, and thus reduce its force of gravity to allow another change to be made, by which the water is conducted in separate directions from and to the cistern.

111. Jib-boom for Vessels; Charles L. Linnell, Truro, Massachusetts.

Claim—The application of the after jib-boom to the bowsprit by means, not only of the slide rod applied to the bow-sprit, but the slider connected with the boom.

112. Spoke-shave; Benjamin Tolman, Assignor to self and A. T. Ramsdell, Pembroke, Massachusetts.

Claim—A spoke-shave, constructed with an adjustable knife and adjustable throat gauge, arranged and applied to the stock so as to move with respect to one another.

113. Bench Plane; Wm. S. Loughborough, Rochester, New York.

Claim—1st, The combination of the screw, 2 (which takes effect in the projection, B), spring or yielding cap, bit, and screw, 1, for the purpose of varying the cut of the bit, and at the same time, and proportionally, the space of the throat, the base of the bit being the fulcrum upon which it swings when said changes are made, the said combination being applicable for the adjustment of the bit in all kinds of planes. 2d, The adjustable parallel fence, constructed with diagonal slots for the set-screws, said fence being applicable to match planes, and also the stop with the slot running up diagonally from the face, the set-screw, and the guide pin keeping it in position, said stop being applicable to panel ploughs and dadoes.

114. Improved Rotary Engine; Samuel D. Lount, Summerville, Michigan.

Claim—The arrangement and combination of the rotating head, provided with sliding pistons, and placed eccentrically within the case, the saddles applied to the pistons and the valves.

115. Apparatus for Laying Metal Leaf on Mouldings, &c.; Robert Marcher, City of New York.

Claim—The method of laying leaf metal on mouldings, and other surfaces, by means of a roller. Also, operating the roller in laying leaf metal on surfaces by the force of capillary attraction. Also, the combination of the rails, the table for holding the book of leaf metal, and the means for holding the article to be gilded or silvered, or the equivalents of the said elements, in combination with the roller. Finally, the combination of the roller and rails, or equivalent guide ways, with the rebate, or equivalent gauge.

116. Railroad Switch; T. Mayhew, Poughkeepsie, New York.

Claim—The employment or use of the adjustable platform, in connexion with the switch bar and gearing, springs and stops.

117. Pump Boxes, John Munson, San Jose, California.

Claim—Constructing the pump boxes of the rings and bands, provided with the uprights and the traverse plates, when the boxes thus constructed are provided with the valves fitted thereon. Further, securing the lower box in the bottom of the cylinder, by means of the traverse plate on said box, and flanch, secured to the inner side of the cylinder.

118. Plant Protectors; Eli Mosher, Flushing, Michigan.

Claim—The arrangement and combination of the folding sides, cover, and fastening cord.

[These protectors are simply rectangular wooden boxes covered at the top with gauze or some other material which will admit the sun's rays, air, and moisture, and at the same time exclude the insects; the boxes being set over the plants they are to protect.]

119. Wind-mills; Wm. McAllister, South Reading, Massachusetts.

Claim—The series of narrow sails attached to vertically sliding rods, and united by means of the cords, and operating in combination with the adjusting ropes.

120. Ploughs; James C. Molthrup, Bucyrus, Ohio.

Claim—Giving the beam longitudinal and vertical motion by means of the bearing plates, slots, short rear bolt, b, and long vibrating front bolt.

121. Manufacture of Felt Hats; James Monach, Rahway, New Jersey.

Claim—The corrugation of the brims of felt or soft hats by the employment of dies on both sides of the brim, whereby the corrugation is attained without stretching the brim, both the surfaces being finished at one operation.

122. Roasters; James Mulligan, City of New York.

Claim—The detachable journal bearings, constructed so as to be clamped on to the edges of the openings in the stove or range, and receive the spit.

123. Ploughs; Williamson Nichols, Floyd Co., Georgia.

Claim—The arrangement of the forked beam, segmental head, holes, bolts, clevis, stock, handle, rivet and holes.

124. Bridles; R. B. Norvell, Huntsville, Alabama.

Claim—The cord, attached to a bridle or halter by passing the same through the bit rings or halter rings, and over the pulleys, or their equivalents, and under the throat of a horse, or other animal.

125. Iron Ties for Cotton Bales; James Nuttall, New Orleans, Louisiana.

Claim—The combination of the plate and movable clasp, when made use of in confining the hooks as a fastening for iron ties for cotton bales.

126. Clothes Frame; Henry A. Nutting, South Amherst, Massachusetts.

Claim—A clothes frame, composed substantially of the rod or stem, the two hubs, and the two sets of arms.

127. Cultivators; Isaac B. Palamountain, Tarboro', North Carolina.

Claim—The arrangement of the beam, stock, centre bar, standard, wings, share, and seat.

128. Horse Hay-rakes; George S. Reynolds, East Bethel, Vermont.

Claim—The arrangement of the boxes, arch arms, elastic spring, shoe, strap, t, frame, and strap, l.

129. Tools for Manufacture of Fire Arms; Augustus Rebetey, Norwich, Connecticut.

Claim—The use of a crank shaft to carry a cutter, such crank shaft suspended at the centres of an engine lathe, or any similar machine, and receiving its motion from the counter-shaft of such lathe, or similar machine, for the purpose of cutting an eccentric shaped slot in the barrel of a pistol, or anything else.

130. Water Wheels; Sylvanus Richardson, Jericho, Vermont.

Claim—The construction and arrangement of the shutes formed by irons, and the arrangement of openings in plate f, in fig. 3, and corresponding openings in plate f, in fig. 5, and the arrangement of plate, c c, and wheel, and case, and draft tube, and the combination of the same.

131. Hemp Brakes; John W. Rinehart, Lexington, Missouri.

Claim—The particular manner of operating the beater frame, by means of the lever, j, links, lever, l, shaft, arm, connecting rod, and crank.

132. Hernial Trusses; S. S. Ritter, Philadelphia, Pennsylvania.

Claim—1st, The construction of a surgical truss having a short spring with one or more plates of metal, extending in front about half round the body, and held by a strap or straps, forming the other half of the girdle, when the said spring is curved, as shown, for the purpose of making a more agreeable pressure on the hernia, and for fitting the ends of the spring better to the hips, thus rendering the truss more comfortable to the patient. 2d, The described pad, having a central prominence surrounded by a groove and ridge, when the face of said pad is made in one piece.

133. Apparatus for Vulcanizing Rubber; Edward A. L. Roberts and Wm. J. Demorest, City of New York.

Claim—The general arrangement of the stove, boiler, and vulcanizing chamber.

134. Grain Shovels; David B. Rogers, Pittsburgh, Pennsylvania.

Claim—The so bending a plate of iron into the shape of a shovel as to form a socket for the handle out of the same piece of iron.

135. Clock Dial; S. E. Root, Bristol, Connecticut.

Claim—The combination of a clock dial, metallic back, and frame, specifically as described.

136. Printing Presses; Stephen P. Ruggles, Boston, Massachusetts.

Claim—1st, The combination of two screws having different sized threads, and operating together to give a greater motion to a platen, or its equivalent, at one time, and more power at another time, as may be desired. 2d, Connecting two such screws together, and to the lever or bar that actuates them, by a strong helical spring, that, by being wound up, becomes a clamp, so as to put the two screws in action one after the other. 3d, Running out the bed of the press on inclined ways for the purpose of increasing the distance between the bed and platen, which makes a better entrance for the frisket, blanket, sheet, form, &c., by affording more space when they are being run under the platen.

137. Automatic Primer for Fire Arms; Jacob Rupertus, Philadelphia, Pennsylvania.

Claim—1st. The feeding slide lever, applied in combination with the hammer to constitute a portion of the thumb-piece thereof, and with an interposed spring. 2d, Constructing and applying the feeding piston to roll within the magazine, as set forth. 3d, Attaching the feeding piston which drives the priming forward in the magazine to a spring or flexible driver, which winds on and off a spring barrel.

138. Pumps; John Selaer, Williamsport, Pennsylvania.

Claim—1st, Draining the standing pipe and relieving the air chamber from pressure by allowing the water to escape upward through the cylinder, whenever the plunger rod is sufficiently depressed, thereby draining the pipe without draining the pump itself. 2d, The splash plate with its aperture, when used in connexion with the vertical termination of the discharge pipe.

139. Shafting for Endless Chain Horse Powers; Theodore Sharp, Bloomington, Illinois.

Claim—The sliding shaft, reels with slotted or mortised hubs, constructed and operating as described.

140. Seed Planters; David M. Smith, Springfield, Vermont.

Claim—The combination of the following devices for operating the dropping slide, viz: the spring, the rack, the pinion, the rack lifter, the groove of the rack, and the latch. Also, the application of the rack lifter to the rack so as to be adjustable thereon, in the manner set forth. Also, combining with the rack and apparatus carried by it, the latch elevator for moving the rack out of gear with the pinion, and holding the rack from slipping or being thrown backward, the object being not only to prepare the rack for causing the machine to plant the first dropping of seed in the right place, but to hold the rack out of gear with the pinion while the machine is being moved over the ground, where it may not be desirable to have it plant seed.

141. Rotary Steam Engines; Mathew Smith, Pittsburgh, Pennsylvania.

Claim—The combination and arrangement of a revolving cylinder, steam chest, cam yoke, supply and exhaust passages, with a stationary cam, supply and exhaust chambers, when combined and operated as described.

142. Lathes for Turning Irregular Forms; Charles and Andrew Spring, Boston, Massachusetts.

Claim—The combination of a griping chuck by which an article can be so held by one end as to present the other free to be operated upon, with a rest preceding the cutting tool, when it is combined with a guide cam, or its equivalent, which modifies the movement of the cutting tool.

143. Apparatus for Superheating Steam; George A. Stone, Roxbury, Massachusetts.

Claim—A steam jet, or the equivalent thereof, located substantially in the position and serving the purposes specified, in combination with a superheating apparatus, which is heated by a portion of the gaseous products of combustion.

144. Raking Attachment for Harvesting Machines; George Tatlock, Salem, Indiana.

Claim—Operating the rake-head which is pivoted to the sliding bar through the medium of the rotating shaft, connecting rod, rock shaft, connected respectively with the rod and sliding bar by the arms, in connexion with the arm attached to the rake-head, the loop or guide attached to the arm, and the bars or arms attached to the platform.

145. Bureau Bedstead; H. L. Thistle, City of New York.

Claim—Combining the bedstead frame with the wardrobe, or other case, by means of the hinged links and movable slides, whereby the bed can be let down to a lower level than by any other construction before known, while at the same time it can be let down by a single movement, and within a space no longer than the bedstead, and without the necessity of first drawing out part of the structure from the wall, or making joints in the side rails or pieces, the hinged links and slides giving to the structure all the foregoing advantages. Also, in combination with the bedstead frame connected with the case by the hinged links and slides, the weighing of the head end of the frame to balance the weight of the foot end when lifting it up, and thereby facilitate the manipulation. Also, forming the support for the foot end of the bedstead frame by a hinged panel, so that the said support, when the bed is thrown up, shall form part of the front of the wardrobe, or other piece of furniture.

146. Harvesting Machines; Samuel Thomas, Burnett, Wisconsin.

Claim—The false pole with its attached sliding gauge, which may be adjusted at pleasure, so as to prevent side draft and pressure upon the near horse.

147. Rotary Harrows; George W. Toleman, Augusta, Kentucky.

Claim—The arrangement of the frame, shaft, iron circle, roller, rods, and rod or hook, operating conjointly, as set forth.

148. Stoves; John Van and Henry V. Barringer, Cincinnati, Ohio.

Claim—The swinging grated door or hearth, and sliding swinging register, in combination with the supporting legs and stove, arranged as set forth.

149. Hillside Ploughs; Edward Van Camp, Beadington, New Jersey.

Claim—Making the share, the landside, and the landside brace of hillside ploughs, each in one piece, and uniting them together to the mould-board and beam, in the manner set forth.

150. Grain Separators; James Vaughn, Magnolia, Illinois.

Claim—The arrangement and combination of the semi-cylindrical hopper having a depression in its centre, with the screen, buckets, spout, n, fan, and spout, i, as described.

151. Meat Slicer; Wm. Vine, Hartford, Connecticut.

Claim—The beveled lip and the pendant, for the purpose described, in combination with the other parts of the dried meat slicer.

152. Lock; Thomas K. Webster, Lawrence, Massachusetts.

Claim—The guard or fender, as described.

153. Churn; Leonardo Westbrook, City of New York.

Claim—The use of the projecting rim and the revolving disc working over the same, in combination with the fixed and revolving radial dashers, and with or without the regulating thumb-screw.

154. Ice-pick; Milton, Howard, Henry T., and Joseph White, Philadelphia, Pennsylvania.

Claim—The combination of the ball and tube sliding upon the stem, in such a manner that the blow may be struck upon the head of the stem.

155. Stoves; John George Widmann, City of New York.

Claim—The arrangement and combination of the gas tubes with the cylinder and fire openings, so that the gases which arise from the heating of the coal will be compelled to pass down into the fire.

156. Harvesting Machines; Hosea Willard and Robert Ross, Vergennes, Vermont.

Claim—1st. The arrangement and combination of the hinged bar with the lever, as described. 2d, The arrangement and combination of the adjustable spring, bar, adjustable rod, spring, and finger bar, as described.

157. Harvesting Machines; Wm. H. Wilson, Denton, Maryland.

Claim—1st, The combination of the vibrating sector, rack, lattice frame, and carriage, with the beam, or its equivalent, and the rake. 2d, In combination with the rake having its centre driven backward and forward over the platform, the swiveling plate, ratchet, and pawl, and adjustable shifting stop, or its equivalent, whereby the rake is turned upon its centre and caused to sweep the grain off. 3d, In combination with the rake having its centre driven back and forth over the platform, as specified, the guiding plate and rolls, or their equivalents, whereby the rake is thrown back into the proper position to sweep across the platform after having discharged a sheaf. 4th, The combination of the rod, M, with the rod, S, arm, cam, and spring. 5th, The stop, arranged as described.

158. Combined Metallic Street Curb and Gutter; Wm. E. Worthen, City of New York.

Claim—The compound metallic curb and gutter, constructed in the manner specified.

159. Ploughs; T. J. de Yampert, Shohola, Pennsylvania.

Claim—A revolving cone having under-cut or overhanging curved flanches or wings that extend entirely from the base to the point of the cone, so that it will revolve upon its shaft or journal by the resistance of the earth alone against it, and without being driven by other forces. Also, in combination with a cone furnished with spiral under-cut flanches, and revolving by the resistance of the earth against it, the mould-board and landside for turning over the loosened earth, and directing the plough in its path, as described.

160. Pruning Knife; G. G. Belcher, Assignor to self and Joseph S. Hill, Worcester, Massachusetts.

Claim—1st, Arranging the blade of a knife in such a manner that it opens and closes by turning one or both parts of the handle. 2d, The pins on the blade, arranged in combination with the slots in the plates of the handle, for the purposes of operating the blade and keeping the same rigid when it is opened as well as when it is closed. 3d, The slide, or its equivalent, arranged in combination with the eye, for the purpose of securing the two parts of the handle together.

161. Boot-crimping Machines; James D. Black, Assignor to self and Ezekiel Hallet, Jr., Boston, Mass.

Claim—Machines for crimping boot-legs, in which the "hitch-on" is raised by the hand of the operator, pivoting the device by which the "hitch-on" is raised to a spring clock, or its equivalent. Also, the peculiar construction of "hitch-on" described, the movable jaws being temporarily closed upon both sides by a spring, so that they may be separately opened for the insertion of the leather, and may be permanently closed by a single screw.

162. Hand-plane; Simeon S. Dodge, Sunapee, Assignor to self and Edmund Burke, Newport, N. H.

Claim—1st, The curved adjustable cap iron, constructed as described. 2d, The combination of the adjustable cap iron with the bolt, the set-screws, the thumb-screw, and the break iron, as described.

163. Knapsacks; Wm. Griffiths, Assignor to self and Joseph H. Lambert, Philadelphia, Pennsylvania.

Claim—A military knapsack having the usual frame or case, made and adapted thereto, so as to be convertible.

164. Corn Planters; Wm. H. King, Assignor to self and Nelson Colson, Charleston, Illinois.

Claim—1st, In combination with the cams and the arm, the arrangement of the rods in such relation to the seed cells that they push out the corn contained in the same. 2d, The arrangement of the marker, in combination with scraper, so that the same never fails to make a clear mark in the track of the driving wheel.

165. Seed Drills; Charles Learned, Assignor to self and George P. Stevens, Indianapolis, Indiana.

Claim—The guard or series of straps, in combination with the toothed roller and elastic guard, when operated in connexion with the roller and agitator.

166. Making Steels for Sharpening Knives; Samuel Lee, Assignor to Charles S. Pomeroy, Taunton, Mass.

Claim—The combination of these devices, so that by their continued action they shall produce a steel with sharp ribs or edges in the direction of its length.

167. Cooking Stoves; Henry G. Leonard, Assignor to Lemuel M. Leonard, Taunton, Massachusetts.

Claim—So constructing and arranging one or more of the oven plates of the stove, that it or they can be removed, and the flue or flues cleaned, and the plates replaced, without loosening or separating the plates which form the outside of the stove. Also, making one or more of the interior flue plates, so that it can be removed and the flue cleaned, and the plate replaced, without loosening or separating the plates which form the outside of the stove.

168. Single Thread Stitches; James S. McCurdy, Assignor to Elias Howe, Jr., Brooklyn, New York.

Claim—A single thread interlooped stitch, in which each successive loop is encircled by a tight coil of the thread of the preceding loop.

169. Device for Suspending and Liberating Ships' Boats; Daniel P. Mealey, Assignor to self and A. E. H. Johnson, Washington City, D. C.

Claim—The hanger, constructed with a seat or seats for the ring of the boat to rest upon, in combination with the seat formed in the tumbler, in such manner that the seat or seats of the hanger shall coincide with the seat in the tumbler, that a large proportion of the weight and strain may be supported by the hanger, which increases the power of the device to resist strains, and facilitates the unlatching of the tumbler. Also, in combination with the arrangement of the opening in the tumbler, in combination with the seats and that portion of the hanger which rises above and overhangs them, in such manner that when the seats of the hanger and tumbler coincide, the mouth of said opening will pass and be inclosed by the

hanger. Also, in combination with the tumbler and hanger, extending the legs of the hanger below the range of motion of the opening in the tumbler, so as to form a cut-off to the passage of the ring, and thus prevent it from being carried round with the motion of the tumbler. Also, in combination with a boat detacher making a recess or shoulder in the tumbler, in combination with a snug or projection on the dead eye, whereby the connexion of the ring of the boat with the tumbler may be made with one hand, when necessary.

170. CHURN; James O. Merrill, Assignor to Wm. A. Swain, Chichester, New Hampshire.

Claim—The arrangement of the oscillating lever and its weight with the vibrating shaft, the vibrating lever, the auxiliary levers, and the alternate reciprocating dasher arms, with their dasher, by which the oscillating power of the pendulum is applied to the process of churning butter.

171. FACTITIOUS ENAMELED LEATHER; James W. Munroe, Assignor to John Southworth and Wm. R. McKenzie, Fall River, Massachusetts.

Claim—The artificial leather, composed of two or more thicknesses of cloth united by cement and varnish, as set forth.

172. MACHINES FOR DIGGING AND GATHERING POTATOES; Jonathan B. Parvin, Assignor to self and Elias Stratton, Heightstown, New Jersey.

Claim—The combination of the weed cutter and roller, when mounted on a swivel and applied to a potato digger. Also, hinging the frame that carries the plough and the endless apron on the shaft, when used in combination with the lever, links, and rods, by which the operator from his seat can raise up, lower, or hold up the plough and apron. Also, the combination of the adjustable endless apron, horizontal and vertically vibrating grate, and the elevating apparatus.

173. BASIN COCK; G. W. Randall, Assignor to Reuben J. Todd, Boston, Massachusetts.

Claim—The wash basin cock or faucet, as made with cold and hot water inlet passages, and the column passages, arranged in the socket and column, and with respect to the discharging spout, in order to enable a person, by turning the movable part or parts, to discharge either cold or hot water, or a mixture of the same from the faucet, or to close off both hot and cold water induction passages, as circumstances may require.

174. TOOLS FOR MANUFACTURING PISTOLS; Augustus Rebetey, Norwich, Connecticut, Assignor to the Manhattan Fire Arms Manufacturing Co., City of New York.

Claim—The use of a frame having a profile in one plate of it, to shape and finish a corresponding recess in the side plate of a pistol, by means of a revolving cutter governed by the outlines of said profile.

175. ROTARY CUTTERS AND MODE OF OPERATING THEM FOR MOULDINGS; Frederick Schute, Assignor to self and Philip P. Weis, Philadelphia, Pennsylvania.

Claim—A revolving cutter, with any convenient number of double cutting edges of the form of the tongue, groove, bead, or hollow to be cut—one cutting edge being the reverse of the other in each pair, so that one cutting edge only of each pair shall have a cutting effect, when the cutter revolves in one direction—the other edge to cut when the cutter revolves in a contrary direction, and so that one cutting edge of each pair shall act as a guard, to prevent the adjacent edge from penetrating too deep into the wood, when the said cutter with double-cutting edges, thus constructed, is secured to a spindle capable of having the direction of its rotation readily reversed.

176. STEAM ENGINES; G. F. Lombard, New Orleans, Louisiana; patented in England, October 10, 1857.

Claim—1st, The relative arrangement of two cylinders, four pistons, two rocking beams, two steam chests with valves, and the specified connexions which combine and operate the same, in the manner set forth. 2d, The application of the exhaust steam of the engine to the crank or eccentric shaft, through a fly-wheel, constructed and combined with the engine and crank shaft.

177. STEAM ENGINE; J. A. Whipple, Assignor to James Whipple and B. F. Cooke, Boston, Massachusetts.

Claim—The described intermittent rotary engine, consisting of the cylinder, the heads, and pistons.

178. STEAM AND WATER GAUGE; Cornelia H. Williams, Williamsburg, New York, (Administratrix of the estate of Augustus Williams, deceased,) Assignor to Anthony Pollak, Washington City, D. C., Assignor to A. N. Clark, Beverly, Massachusetts.

Claim—1st, Combining the vessel separate and distinct from, but connected to, the boiler by means of two pipes containing a float having an indicator or pointer attached thereto, with the transparent tube or steam chamber. 2d, The general arrangement of the instrument for forming an alarm water gauge, by combining with the water gauge a whistle, attached to a separate chamber containing a valve arranged to be operated by the float, so as to admit steam to said whistle, to give alarm when required.

179. HORSE-SHOE MACHINE; J. B. Collen, Assignor to self and Pascal Yearsley, Philadelphia, Pennsylvania.

Claim—1st, Bending the heated bar of iron to the requisite form, by applying it to a revolving former of the shape of the inside of the shoe, when the said former is arranged to hold the bent iron, while it is acted upon by the dies. 2d, The combination of the revolving former with the cutter, when the latter is so arranged in respect to the former, that the edge of the cutter shall coincide, or nearly coincide, with the circular path traversed by the outer edge of the former, and when the cutter is hung to the movable bar, or its equivalent. 3d, The die, the spindle, its former, and the sleeve, in combination with the counter-die on the spindle.

180. CORK MACHINE; Albert Albertson, Assignor to C. C. Bean, City of New York.

Claim—1st, The stationary cylinder, or any substantially equivalent device, when employed to gripe a cork by its periphery, so as to effectually prevent its rotation while being cut by a rotary cylindrical cutter. 2d, The feed rollers (with or without the band), arranged and adapted to rotate a cork by friction upon its periphery, while under the action of a longitudinal cutter.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Connexion between the Structure and the Physical Properties of Wood.** By Prof. Knoblauch.

From the "Sitzungsberichte der Naturforschenden Gesellschaft." Halle, 1858, vol. v.

The author seeks to ascertain *whether any connexion is ascertainable between the structural relations of various kinds of wood and their observed physical properties, such as their powers of resonance and conduction of heat, &c.*, in the same way as was done for one and the same wood by Savart in respect to resonance, and more especially by Tyndall in respect to the conduction of heat.

The primary object was to trace the difference in the conduction of heat shown by different woods, according as the heat has to traverse the wood in a direction parallel with, or at right angles to, the direction of the grain. For this purpose, slabs of the woods to be examined were bored through perpendicular to their planes, and then covered as uniformly as possible with a coating of stearine. A hot wire, exactly fitting the bore, was introduced into the latter and continually turned round during the experiment. By this means the coating of stearine around the orifice was melted; but, as we should expect, not in concentric circles, but in elliptic zones, whose major axes invariably coincided with the direction of the grain. The great difference in the behavior of different kinds of wood (about eighty sorts were examined,) under these circumstances is at once apparent. With some the ellipses are tolerably circular, by others more elongated, while by others, again, the major axes are so extended as to be nearly twice the length of the minor ones. The eccentricity of these ellipses, which furnished a graphical expression for the conductive power of the wood in the directions between which the structural difference was greatest, made it possible to divide the different kinds of wood into four distinct groups. In the first, the ratio of the minor to the major axis of the ellipse is on the average as 1 to 1·25. To this group, Acacia, Box, Cypress, King-wood, &c., belong. In the second, and by far the most numerous group, containing Elder, Nut, Ebony, Apple, several dye-woods, &c., the mean value of this ratio is 1 to 1·45. In the third group, to which Apricot, Siberian, Acacia, Brazil wood, Yellow wood from Puerto Cabello, &c., belong, the ratio is as 1 to 1·60. In the fourth group it is as 1 to 1·80, and to this division belong Lime, Tamarind, Iron wood, Poplar, Savanilla (yellow), &c. Hence, *the conducting power of all woods in the direction of the fibre exceeds that in the perpendicular direction by no means in a constant manner, but in one which depends upon the nature of the wood.* This superiority is in the first group so small, that the warmth in the direction of the fibre traverses a path only a quarter more in length than that traversed in the same time in a perpendicular direction. In the last group, on the other hand, the length of the path in the first direction is about twice that in the perpendicular one.

* From the Lond., Edin., and Dub. Mag., May, 1859.

In order to investigate the relations of resonance, two rods were cut from each kind of wood,—the one being taken in the direction of the grain (Langholz), the second perpendicularly across it (Hirnholz). On suspending these rods freely (their length was 470 millims., breadth 20 millims., and thickness 8 millims.) and striking them with a stick, the piece cut with the grain always gives a more sonorous tone than the corresponding cross-grain piece. Nevertheless, the difference of resonance in the tones of the width and cross-grain pieces of one and the same wood, of the first of the groups described (say beech), is unmistakably less than the difference between the tones of the with and cross-grain pieces of any member of the second group. In the second group this difference is less than in the third; and in the third, again, less than in the fourth (as with with- and cross-grain pieces of poplar). *When, therefore, the fibres of all kinds of wood are set in vibration, the purity of resonance is greater when such vibrations are transverse than when they occur in other directions (as when the rods are cut across the grain). But this superiority of resonance is not constant; it depends upon the nature of the wood.* The difference in this respect in the first group of woods is so small, that the resonance of two with- and cross-grain pieces resembles that of two not very dissimilar masses of stone when struck. In the last group the difference is so great, that the tone of the with-grain piece when struck has a metallic ring, while the dull sound of the cross-grain piece reminds one of a piece of pasteboard when struck. *The division of the woods examined, derived from their thermo-conductive power, is accordingly supported by their acoustic relations.*

By supporting the two ends of the rods employed in the above experiments and loading them equally in the middle, the degrees of deflexion which they undergo will give us an insight into their structural relations; for the greater their compactness, the greater the resistance they will offer to bending; and the less compact they are, the more easily will they yield. The difference in vertical height of the middle points of the bent and straight rods was taken as measure of deflexion. A lever was employed to determine this measure, the end of which passed over an enlarged scale in order that the readings off might be the more exact. The unit of this measure was a matter of indifference, inasmuch as in the comparison to be instituted, relations only had to be determined. Although, as was to be expected, in all cases the with-grain piece was much less flexible than the corresponding cross-grain piece, yet an important difference was noticeable in the different groups. This is best seen by calculating the relation between the bending (measured as above described,) of the with-grain and that of the cross-grain wood; that is, the same weight being applied (say 100 grs.), by dividing the number given by the lever with the cross-grain piece by that given with the with-grain piece. This relation (called "ratio of deflexion" in the following Table) has, in the first group, the mean value of 1 to 5; in the second, 1 to 8; in the third, 1 to 9·5; in the fourth, 1 to 14. The division of the

4*

groups is therefore also supported from this point of view.* *The difference in the structure in the different directions is least in those woods which show the least difference with respect to direction in their thermo-conductive and resonant properties; and the difference in the former is greater or less as the two latter differences are greater or less.*

Hence, a definite relation may be established between the different phenomena described; and this is true to such an extent, that the knowledge of one of them, e. g., *the mechanical or state of cohesion is sufficient to deduce the others, those of warmth or resonance.*

Thus, merely to adduce one example, especial experiments had shown that in petrified woods a difference of structure in the directions parallel with, and perpendicular to, the direction of the grain had been preserved , and, in fact, the thermal curve was an ellipse whose major axis was parallel to the fibres. As in the petrified example, this difference in mechanical structure was much less than in the living wood, so, also, while in the living Conifer the ratio of the axes was as 1 to 1·80, in the petrified specimen it had sunk to 1 to 1·12.

The following Table contains the names of the woods examined, arranged according to the groups mentioned:—

Group I.

Ratio of the axes of the thermal ellipse 1 to 1·25. Mean ratio of deflexion 1 to 5·0.

Acacia.	King wood.
Box.	Satin wood.
Lignum-vitæ.	Salisburia (*Gingko*).
Cypress.	

Group II.

Ratio of axes of thermal ellipse 1 to 1·45. Mean ratio of deflexion 1 to 8·0.

Elder.	Snake wood.
Alder.	Zebra wood.
White Thorn.	Purple wood (*Amaranthus*).
Arbor vitæ.	Settin.
St. Lucian wood.	Coromandel wood.
Gymnocladus canadensis.	Angica wood.
Beech (2 species, white and red).	Cocoa wood (*Gateado*).
Plane.	Apple.
Elm.	Pear.
Oak (two species).	Cherry.
Ash.	Plum.
Maple.	Sandal (red).
American maple.	Caliatour.
Cedar of Lebanon.	Costarica (red wood).
Australian cedar.	Bimas sapan.
Mahogany.	Cuba (yellow wood).
Palisander.	Viset (yellow wood).
Ebony.	Campeachy blue wood.
Palm.	Tobasco blue wood.
Rosewood.	Domingo blue wood.

Group III.

Ratio of axes of thermal ellipse 1 to 1·50. Mean ratio of deflexion 1 to 9·5.

Apricot.	Pernambuco red wood.
Pistachio.	Japan red wood.
Siberian Acacia.	Puerte-Cabello yellow wood.

* The diversity of nature, even with one and the same kind of wood, of course did not admit of the boundaries of the groups being drawn with great exactness, or of the subdivision of the groups into secondary ones.

Group IV.

Ratio of the axes of the thermal ellipse 1 to 1·8. Mean ratio of deflexion 1 to 14·0.

Willow (two examples).
Chestnut (three examples).
Lime.
Alder.
Birch.
Poplar (three examples).
Aspen.
Pine.
Fir.
Weymouth fir.
Magnolia.
Iron wood.
Tamarind.
Palmassu.
"Kistenholz."
Caoba (Havanna Cedar).
Savanilla yellow wood.

*Electro-telegraphic Progress.**

A foreign scientific journal gives the following summary of the different lines where submarine telegraphs have been laid, up to the end of 1858.

Dates.		Length in miles.
1850.	England and France,	22¼
1852.	England and Belgium,	70¾
"	England and Ireland,	64
1853.	England and Holland,	107½
"	Ireland and Scotland,	24¾
1854.	Italy and Corsica,	64
"	Corsica and Sardinia,	9¼
"	Denmark (Great Belt),	14¼
"	Denmark (Little Belt),	4¾
1855.	Denmark (Channel of the Sound),	11⅛
"	Scotland (Frith of Forth),	3½
"	Black Sea,	371¼
"	Solent (Isle of Wight),	3
1856.	Straits of Messina,	4¾
"	Gulf of St. Lawrence,	74
"	Strait of Northumberland,	9¼
"	The Bosphorus,	1⅛
"	Nova Scotia (Isthmus of Canso),	1¾
"	St. Petersburgh and Cronstadt,	8
1857.	Sicily and Algeria,	149½
1858.	Bay of Valentia (Ireland) and that of Trinity (America),	1827¼
	Total in 1858,	2771¼

* From the Lond. Builder, No. 844.

Use of Birds.

The *Bulletin* of the Brussels Society for the protection of animals, published the following curious and interesting fact:

Until a few years ago, the Park at Brussels was shaded by trees of luxuriant foliage which met over the alleys and screened the promenaders entirely from the sun. These trees were filled with birds whose indiscretions occasioned now and then a little annoyance to the elegant toilettes below. For this reason they were banished; in a few weeks, the

leaves of the trees were in holes and dying—and now, the branches almost entirely without verdure, and loaded with caterpillars, and the walks infested with moths. *Cosmos.*

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*On Professor Hughes' System of Type-printing Telegraphs and Methods of Insulation, with special reference to Submarine Cables.** By Mr. H. Hyde.

The several phenomena which have been manifested in the working of long submarine telegraph cables, demonstrate the necessity of improving the insulation of the wires, and of economizing the transmission and recording of symbols. Imperfect insulation not only implies a diminution of the electric current, but may, and frequently does, increase to a total loss, and the cable becomes useless.

The insulation being good when the cable leaves the manufacturer, it is subject to so many accidents before it reaches the bottom of the ocean, that the chances are greatly in favor of a long line receiving some damage, which cannot be repaired after it is laid down. More perfect insulation, and a self-restoring power which should make the cable itself, even at the bottom of the ocean, repair any accidental defect, are most important desiderata in the science of ocean telegraphing.

The great expense of a length of cable, of any construction, sufficient to join England and America, must necessarily be such as to render economy of time in the transmission of messages a matter of primary importance.

Through a single wire, the waves of the electric force can only follow one another in single file. Whatever may be the time occupied in the transmission of a single wave, it is of no small importance, whether it takes from five or six, or only a single wave, to communicate the signal of any letter of the alphabet. The short experience of the working of the Atlantic cable has demonstrated the importance of these positions. I need therefore offer no apology to the members of the Society of Arts, for bringing before them the methods by which Prof. Hughes seeks to improve the insulation of submarine and other wires, to render them self-repairing, and to economize and render at the same time the means of despatch accurate and self-recording.

First—Insulation.—Gutta-percha has been found to be the best insulation for long submarine lines. This substance, however, is more or less porous; minute flaws may exist, which do not show themselves until some time after the immersion of a cable. This was exemplified by Mr. Henly, who discovered a flaw in his submarine cable, which did not show itself until it had been three or four days under water. To meet these defects, to fill up any minute pores in the gutta-percha, and also to cure any accidental fracture or puncture of it, Prof. Hughes introduces a viscid semi-fluid substance, of a non-conducting character, between the conducting wire and the gutta-percha, or the wire may be first coated with gutta-percha, and the viscid fluid introduced between the layers of gutta-percha. As soon as a puncture is

* From the Jour. of the Society of Arts, No. 321.

made in either of the gutta-percha coatings, the semi-viscid fluid oozes out. It is of such a nature, that it hardens when it comes in contact with the surrounding water.

This hardening or coagulating property allows no more of the fluid to ooze out than is necessary to fill the fracture, and at the same time to glue and unite the separated parts of the gutta-percha.

The first feature in this form of cable is its self-restoring power; but it has another, and perhaps more important one. It has been shown, I think by Prof. Faraday, that a fluid which cannot be decomposed by electricity is the most perfect insulator. Should this be demonstrated in practice, the invention of this form of cable must be valuable as a means for greatly increasing the non-conducting power of the medium surrounding the conducting wire. It is well known that cables become defective in insulation after being submerged for some time. It has been supposed that the forces of the electric current burst the gutta-percha covering under certain circumstances. It has also been urged that, in consequence of this tendency, battery power should be used instead of induced currents.

Professor Hughes has demonstrated that voltaic currents exert no mechanical force whatever upon the insulating coating of a conducting wire.

If there be a defect in the coating it may be enlarged by strong currents, either voltaic or induced. But, if there be no pore or crack through which the current can first commence its work of destruction, no voltaic current would exert sufficient force to tear a piece of paper. This has been shown by putting a piece of cable, three feet long, made upon Prof. Hughes's plan, into a bath of salt water. Its complete insulation was tested by a delicate galvanometer and a battery of 500 cells. A fracture, an inch long, was then made through the gutta-percha and the viscid substance, allowing the salt water to reach the wire; the galvanometer immediately was deflected from zero to 90°, showing dead earth.

In the course of five or ten minutes the viscid substance worked its way around the uncovered wire, and oozed out to the water through the fracture. It then coagulated, aud thus repaired the injury, and completely restored the insulation. The whole force of the current from the 500 cells was kept constantly passing into the wire during the whole of this operation.

In illustration of the varied effects of different descriptions of fractures upon submerged cables, it may be instructive to note that if the conducting wire be made bare by a fracture of considerable size, having breadth as well as length, the immediate effect will be dead earth, or the instantaneous deflexion of the needle to 90°. If the fracture be fine or narrow, the effect will be a deflexion of the needle to a greater or less extent, say from 70 or 90°, with a constant vibration of from five to ten degrees or even more. This deflexion and the vibrations will continue as long as the current is kept upon the wire, and often resemble the vibrations produced by a manipulator. This peculiar phenomena may, in some degree, account for the peculiar vibra-

tions which so much puzzled the electricians during the short life and last moments of the Atlantic cable. These vibrations are probably produced by the decomposition of water by the electric current. The hydrogen gas escaping from the point of contact with the wire in an elongated bubble fills the fracture while passing through it, thus alternately opening and closing the circuit.

Secondly—Instruments.—In the early history of electric telegraphing, inventors were impressed with the advantages of using the alphabet in general use for transmitting communications, instead of characters or symbols, a mode which naturally suggested itself as the best, if practicable.

While electrical knowledge was confined to but few, mechanical knowledge, as applicable to its development, was also limited in the same or a still greater ratio. Hence, the mechanical means by which electric currents were made to convey or record signals were crude and simple, and the work was, if not cheaply, at least slowly, roughly, and often inaccurately done.

Among the earliest applications of electro-magnetism to telegraphic purposes, was the vibration of a magnetic needle to the right or left, at the will of the operator, by passing an electric current through the apparatus, or around the needle.

These vibrations are arranged into a code of signals, and the receiver spells off the message from the moving needle, and translates the signals to an amanuensis, who commits them to paper. But in the event of errors by this process, there is nothing to show whether the sender's hand was correct, or the receiver's eye undeceived, or the copyist's ear unerring, or, if a difference arises between them, the evidence may be equally in favor of each. To ascertain who is in fault is difficult, the instrument being visual or non-recording. This primitive method is now generally used in Great Britain. On the Continent, however, Morse's self-recording instrument is generally used.

The main features of this instrument consist in making a temporary magnet of a piece of soft iron, by passing a current of electricity through it, attracting an armature attached to one end of a lever, thus pressing a stile upon the other end against a strip of paper moved by clockwork at an uniform rate of speed. By this means the manipulator is enabled to record, both at the home and distant stations, symbols, consisting of short and long lines, with blank spaces. These hieroglyphics are transmitted by the receiving clerk, written out, and enclosed to the person for whom the message is intended.

The Morse instrument is used upon many of the American lines. A roman type-printing instrument, the invention of Mr. House, is also used to some extent in America. It is more rapid than the Morse, printing accurately twelve to fifteen hundred words an hour in ordinary working, and is therefore approved upon lines which have a great amount of business.

It is, however, more complicated than the Morse or the Hughes instruments, and requires an immense battery power to work it, so much so that it is not practicable, upon the best air or overground lines, for

circuits of more than 150 miles, while upon underground or submarine wires it has not, and I believe cannot, be worked thirty miles.

The House instrument is based upon the step-by-step motion, or that the number of waves sent shall determine the letter to be printed. The type is made to revolve by means of a treadle, but is checked at each letter by an escapement, which only allows it to move one letter at a time.

This escapement is moved by the flow of compressed air upon alternate heads of a plunger. The passage of air is governed by a valve attached to the armature of the axial electro-magnet, each wave of the voltaic current causing an action of the magnet, and consequently of the plunger and escapement, by the air force.

Compressed air is used to get greater power on the escapement, as the electric current would be too weak to move the escapement, whilst sufficient to move the armatures and valve. In the transmission of a message, the operator sending it, checks a circuit breaker at a certain number of waves, and this stops the type-wheel of the distant instrument by means of the escapement; and, as soon as stopped, a press is unlocked, which imprints the letter.

This unlocking of the press is very ingenious, its action depending on the motion of the type-wheel. The main constituents of this instrument are the transmitting apparatus, a compound axial magnet, and a manual power by which the instruments are kept in motion.

The instruments thus concisely described, as well as all minor ones hitherto worked with one wire, require an average of five or more electrical impulses or waves, or the time equal to this number, to transmit one letter.

The recording in roman type each letter of a message by a single wave, upon one wire, is the triumph of the Hughes system. To accomplish it, several requisites are necessary, which it may be proper to state, and then proceed to show how they are each obtained, and, united in one harmonious whole, producing that life-like automaton present to demonstrate before you what is advanced, and practically speak for itself in plain English.

These requisites are, first, synchronous motion; secondly, an electro-magnet, by which the timing of the electrical wave may be accurately measured; thirdly, a writing apparatus, by which the message may be correctly, rapidly, and easily transmitted; fourthly, a printing apparatus, by which the operator can record the message unerringly upon his own instrument, as well as upon the one at the distant station.

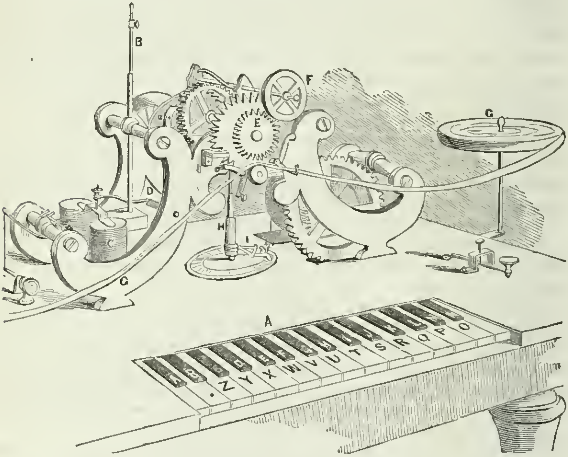
Many inventors have attempted to make an instrument, by which a letter could be sent by one wave, but without success. One reason was, that they had no governor of sufficient velocity and accuracy, to produce rapid synchronous motion.

Prof. Hughes applies a vibrating spring to govern his instrument. It is a well known law that a certain number of vibrations produces a certain musical tone; therefore, if two or more springs have the same tone they must necessarily have a similar number of vibrations in the

same time. The instruments are kept in motion by a weight acting upon a train of wheels, the spring governor acting upon them by means of an ordinary escapement.

These vibrations may succeed each other with any degree of rapidity required. They are regulated by a small weight attached to the spring, and raised or lowered until the number of vibrations or desired tone is produced. This can be done easily and quickly, although the instruments may be any number of miles apart—say between London and Paris, or Ireland and America.

The type-wheels of the instruments now exhibited, revolve at the rate of one hundred and twenty revolutions per minute, and the governor makes fifty-six vibrations for each revolution of the wheel.



A. Key Board.	D. Detent.	G. Paper Printed upon.
B. Vibrating Spring.	E. Type-wheel.	H. Revolving Shaft.
C. Electro-magnet.	F. Ink Roller.	I. Revolving Arm or Circuit Closer.

The Magnet.—The Hughes magnet is of peculiar construction. A permanent magnet polarizes the cores of an electro-magnet, and holds an armature in contact with its poles. A spring is attached to this armature, and so adjusted as to exert a counteracting power a little weaker than the force of the magnetic attraction. If, therefore, the magnetic force be diminished, the armature is removed from the poles of the magnet by the force of the spring.

The arrangement is such that the current of electricity passing through the coil when the circuit is completed, induces an opposite magnetism to that of the permanent magnet. The electrical force,

therefore, which works this instrument, need not be sufficient to induce such a degree of magnetism, as to render the core sufficiently magnetic to attract an armature to its poles—the practice in all other recording telegraphs. For instance, if the cores of the electro-magnet, polarized by the permanent magnet, have a holding force upon the armature of ten, and the spring attached to the armature be adjusted with an opposing force of nine, then a current of one reducing the force of the electro-magnet, would cause the spring to rise with the force of nine.

This arrangement can in practice be so nicely adjusted as to work with a very feeble current, and accurately measure the timing of the electrical wave. The armature being mechanically restored to contact with the poles, has the advantage of being acted upon by the maximum power of the electro-magnet, instead of a power lessened by more than the square of the distance the armature has to be attracted, as is the case in the relay magnets used in connexion with the Morse and other systems.

Transmitting Apparatus.—The letters of the alphabet, as well as a dot and a blank, are marked on twenty-eight keys, arranged like those of a piano, save that they are alternately black and white. These keys correspond to twenty-eight holes arranged in a circle on the horizontal floor or table of the instrument, immediately in front of the keys. Each key is connected by a lever with a little steel knob, which, when the key is pressed down by the finger, rises up through one of the holes. An arm, connected with a vertical shaft, sweeps over the twenty-eight holes. If a key marked with a particular letter be touched, the knob corresponding with this letter rises, the revolving arm passes over it, and for the instant closes the circuit, and allows an electrical impulse to be transmitted. This impulse, by arrangements which will be described in the printing apparatus, causes the particular letter to be recorded on a slip of paper in printer's ink. The instant the arm passes over the little raised knob the circuit is broken, and if the finger were held a hundredth part of a minute on the key, the hand would pass again over the knob, and the letter would be repeated. To prevent this, the hand carries, after the portion of it which rides over the knob and completes the metallic contact which closes the electrical circuit, a little inclined plane, which throws the knob out of its position, so that the hand cannot pass over it on any future revolution after the first contact. This arrangement is rendered necessary to prevent the repetition of letters, on account of the extreme rapidity of the revolving arm and recording apparatus.

Printing Apparatus.—A shaft, which revolves seven times faster than the type-wheel, has a fly wheel upon it to overcome the inertia of a small shaft which moves the printing press. This shaft is locked to the fly-wheel shaft by means of a clutch, which rests upon a small inclined plane. Whenever this clutch is kept upon the inclined plane, by means of a detent, the fly-wheel shaft revolves independently of the small printing shaft; but as soon as the detent is moved by the

action of the armature of the electro-magnet, the clutch locks both shafts together, and the small shaft is made to revolve one revolution, when the clutch again rests upon the inclined plane, which lifts it off the fly-wheel shaft. A cam is attached to one end of this shaft, which lifts the press and the paper upon which the message is to be printed against the type wheel. The time of the locking of the shafts depends upon the arrival of the electrical wave, and thus, with two instruments in perfect harmony, the operator has the printing apparatus of the distant instrument as completely under his direction as the one before him. But to correct any minute variation in time between the instruments in circuit, there is a corrector, or wheel, attached to this shaft, with hook-shaped teeth, which mesh into corresponding cavities in the type-wheel. The latter being loose upon the shaft, or only held by friction, is removed backwards or forwards by the corrector to exactly the same position as the type-wheel on the instrument from which the message is being sent. This corection takes place in the act of printing every letter. There is also upon this shaft a cam, so arranged that, the moment the armature falls off the electro-magnet and opens the detent, it forces the detent up, and restores the armature to its original position upon the poles of the magnet.

Another new feature in this instrument, is its power of cutting off at will all offices except the one to which it is desired to communicate. This is accomplished by a flanch on the type-wheel—this flanch having a space cut out opposite a certain letter, and each office having the flanch cut out at different letters from each other. A bolt is made to slide through the space, and moved through by the action of the instrument. If this bolt is sent through at the moment the space is opposite, it permits the instrument to run, if not it goes against the flanch and locks the type-wheel.

The operator, knowing at what letter a certain instrument will be unlocked, touches that key. This allows the instrument he wishes to communicate with to run; and he can send the message to that one, the other offices being unable to get it, as they would be locked, and could not bring their instruments into unison with the one sending the despatch. Thus, it is absolutely secret in its transmission, and if necessary, any one could send his own message, as it is only necessary, to ensure its safe arrival, to touch the right keys, which are all lettered.

The electrical circuits are extremely simple. The earth-wire connects with the steel pins or knobs on the keys of the transmitting apparatus, and from the revolving arm through the electro-magnet, and thence through the line and distant magnet to the earth. Reversed currents are not necessary, except on long submarine wires. There may be as many instruments in circuit as may be desired. The European news, consisting of about 3000 words, by the arrival of each Transatlantic steamer, is transmitted by this instrument from Boston to New York, a circuit of about 300 miles, at the rate of 2000 to 2500 unabbreviated words an hour. There are 25 stations on the circuit which receive copies of the news, all of which are printed in plain Roman type by the Boston operator, all the instruments receiving the

message at the same time, the receiving clerks at each station having simply to hand the copy as it arrives to the party entitled to receive it.

The mode of operating with this instrument is extremely simple, and easily acquired. The office desiring to transmit a message calls the station by touching the keys in a pre-arranged order, the distant office at once returns the signal "O K.," or all right. The manipulator then commences the message, first striking the zero key to start the distant type-wheel in unison with his own. If the message is received correctly he is allowed to finish, and then the operator at the distant office gives the return signal of all right; if there is a mistake the receiving office touches his key board, which throws extra letters to the transmitting station, and he then commences again from the point where he made a mistake. There can be no mistake, however, if the operator touches the right key, and manipulators become so expert that they seldom touch the wrong one; if they do, the error is shown by the copy of the message on their own instrument, and immediately corrected.

If I have succeeded in conveying a clear and intelligible impression of the principle of the Hughes system, it may be proper to invite your attention to what appear to me to be natural deductions.

Accuracy is secured by unerring mechanical laws, and not by the skill of the operator, as in the needle or Morse systems. Not only this, but in all other systems, if one of the symbols be missing, another letter is formed by the remaining symbols. *Rapidity* is secured by reducing the labor to its minimum. A single touch of the key prints the letter, instead of three or four vibrations of a needle, or a similar number of motions of a key, as in the formation of symbols to represent letters. Accuracy and rapidity being thus secured, ease and simplicity of manipulation must of necessity follow, and consequently the young operator readily acquires his or her education. The instrument however, is specially adapted to females.

The one-wave system is specially important on long submarine circuits, where electrical impulses are limited, one wave being sufficient for a letter instead of five. Great difficulty has been experienced on long cables by the variation of time in the transit of the wave. By this correct timing instrument, simple and perfect compensation is mechanically attained for any length of wire or extent of variation. The sensitiveness of the magnet also enables this instrument to record more waves upon a long circuit than any I have yet met with. The rapidity of an instrument, however, does not consist only in the fact of its extreme sensitiveness, but also in its power to free itself from the influence of a current so soon as the effect of the current has caused the instrument to record the signal or letter sent. This property, attained by the electrical and mechanical combination of scientific laws, embodied in the design and construction of the instrument, and demonstrated by the results produced, must in time remove all doubt of its superiority, while its English tongue represented in plain printed Roman characters, will tend to make it the favorite of the Anglo-Saxon race.

(To be Continued.)

*On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure rapid and certain communication.** By S. Alfred Varley, Assoc. Inst. C. E.

Since the practical realization of the electric telegraph, several valuable communications connected with the subject have from time to time been laid before this Society.

These papers have generally treated of the mechanical details and improvements in the apparatus which have been designed and brought forward by various patentees and inventors.

In the course of the discussions which have taken place, it has appeared to me that the principles of the science of electricity have not always been sufficiently appreciated, and the practical value of many of the beautiful contrivances not elicited, from not having determined clearly the principles of the science which are involved in telegraphing, and, consequently, the properties which are essential, and must be possessed by all apparatus, to give them a practical value.

This feeling has led me to think that a paper on the Theory of Electricity, keeping always in view its bearing on electric telegraphy, and which should rather treat of the principles of telegraphic apparatus than confine itself to special contrivances, would be subservient to the progress of the object we have in view; for it must not be forgotten that although the world is always indebted to the practical man for the application of science to commercial purposes, and, in the case of the electric telegraph, it is even questionable whether we are not indebted for its very rapid extension in part to the inability of the projectors to appreciate difficulties which the philosopher foreseeing would have hesitated at—or, perhaps, to the greater faith possessed by the practical man in the ability of science to overcome whatever difficulties may present themselves; yet it must not be forgotten that, in the principles of a science, the philosopher is often far ahead of the practical man, and the latter at times comes suddenly and unprepared upon difficulties, which, had he understood correctly the principles long before developed by science, he would have been led to expect as natural consequences. As an example of this, I would mention the case of electric induction, which manifested itself so strikingly when the system of subterranean circuits was considerably extended on the introduction and successful manipulation of gutta-percha.

This phenomenon was unexpected and unlooked for by many, though not all, of our practical electricians; and we find it referred to, and regarded at the present time, as a new fact which the electric telegraph has brought to light, and not one to have been anticipated; yet the laws of induction were beautifully and clearly developed by Dr. Faraday, as far back as 1838; and, when called upon to examine this new telegraphic difficulty, we find him alluding to it in an instructive lecture, delivered before the members of the Royal Institution, as a

* From the Jour. of the Society of Arts, No. 332.

strong confirmation of the truthfulness of views he had put forth as far back as 1838. I would direct attention particularly to this, because I cannot help feeling that our progress is too often obtained by a laborious perseverance in almost empyrical experiments, until, by the laws of chance, a successful result is hit upon, instead of endeavoring, in the first place, to develop a guiding principle, and referring back to it, as each step forward is made, to test both the truth of the principles laid down, and the correctness of the conclusions arrived at. Were this done, experience would not be paid for so dearly; and the commercial application of a science would not be almost paralyzed, as it sometimes is on its first introduction, by the costly series of experiments which have to be gone through before correct principles of working are established.

During March, 1858, the subject of telegraphic cables was very fully entered into by the Institution of Civil Engineers. Finding at that time there were no papers on the electrical portion before the Institution, and feeling that the subject could not be fully considered without the electrical part being entertained, I was induced at the eleventh hour to attempt to supply the deficiency. Some explanation is perhaps therefore due from me for bringing forward, so shortly afterwards, another paper on almost the same subject. Owing to the large number of evenings which had already been occupied in the consideration of the mechanical portion of the problem, and the late hour at which my paper was submitted, it was only read in abstract, and no discussion taken upon it. The views, too, I then brought forward were opposed to some which have lately been laid very prominently before the public, and no opportunity given to contradict them, or to verify their correctness; and as I am convinced that so far from the subject being exhausted, its importance is only now beginning to be appreciated, the opportunity having been offered to me to bring tho matter before the Society of Arts I determined to avail myself of it.

The complete way in which the subject was taken up by the Institution of Civil Engineers is, however, I am glad to say, already bearing fruit; and since the publication of the papers by the Institution, several valuable discussions have taken place in the scientific journals, and in some of the remarks I have to lay before you to-night, I find, to a certain extent, I have been anticipated.

The generally recognised theory of electricity, as I understand it, supposes all bodies in their normal condition to have two powers or forces resident in them directly opposite in their character, being exactly balanced; in bodies in their natural state these forces are completely neutralized and rendered inactive, producing the ordinary condition of matter.

To these powers the name of electricities has been given, and although we are still as ignorant at the present day as the ancients themselves with regard to what electricity actually is, yet the fact of the existence of the electric telegraph is a proof of the progress which has been made in a knowledge of the laws, at least, which govern electric phenomena.

In the year 1838, Dr. Faraday clearly developed the principles of induction and conduction, since which time no further progress has been made in the fundamental truths of the science, though much has been done to confirm their correctness and to develop their consequences.

In the *Philosophical Transactions* for 1838, will be found Dr. Faraday's views on the subject of induction and conduction; and these, to my mind, so clearly explain all electric phenomena, that it will be as well at once to refer to them before proceeding further. After giving reasons for his belief in the identity of induction and conduction, he says, "all these considerations impress my mind strongly with the conviction that insulation and ordinary conduction cannot be properly separated when we are examining into their nature, that is, into the general law or laws under which their phenomena are produced. They appear to me to consist in an action of contiguous particles dependent on the forces developed in electrical excitement; these forces bring the particles into a state of tension or polarity, which constitutes both induction and insulation, and, being in this state, the continuous particles have a power or capability of communicating their forces one to the other, by which they are lowered, and discharge occurs. Every body appears to discharge, but the possession of this capability in a greater or smaller degree in different bodies, makes them better or worse conductors, worse or better insulators, and both induction and conduction appear to be the same in their principle and action, except that in the latter an effect common to both is raised to the highest degree; whereas in the former it occurs in the best cases in only an almost insensible quantity."

In part the 2d of the *Philosophical Transactions* of the same date will be found a summary of Dr. Faraday's views, which I will also quote:—

"1st. The theory assumes that all the particles, whether of insulating or conducting matter, are, as wholes, conductors.

"2d. That, not being polar in their normal state, they can become so by the influence of neighboring charged particles, the polar state being developed at the instant, exactly as in an insulated conducting mass consisting of many particles.

"3d. That the particles when polarized are in a forced state, and tend to return to their normal or natural condition.

"4th. That being, as wholes, conductors, they can readily be charged either bodily or polarly.

"5th. That particles which, being contiguous, are in the line of inductive action, can communicate or transfer their polar forces one to another more or less readily.

"6th. That those doing so less readily require the polar forces to be raised to a higher degree before this transference or communication takes place.

"7th. That the ready communication of forces between contiguous particles constitutes conduction, and the difficult communication insulation; conductors and insulators being bodies whose particles naturally possess the property of communicating their forces easily, or

with difficulty, and bodies having these differences as they have differences of any other natural property.

"8th. That ordinary induction is the effect resulting from the action of matter charged with excited or free electricity upon insulating matter, tending to produce in it an equal amount of the contrary state.

"9th. That it can do this only by polarizing the particles contiguous to it, which perform the same office to the next, and these again to those beyond; and that thus the action is propagated from the excited body to the next conducting mass, and these render the contrary force evident in consequence of the effect of communication which supervenes in the conducting mass upon the polarization of the particles of that body.

"10th. That, therefore, induction can only take place through insulators; that induction is insulation, it being the necessary state of the particles, and the mode in which the influence of electrical forces is transferred or transmitted across such insulating media."

To determine for myself the law which induction obeys, in conjunction with my brother, Mr. C. John Varley, I have tried some experiments.

The principle upon which these were based was that of the dual character of electricity, and the fact established by Dr. Faraday, that all statical charge is sustained solely and entirely by induction.

In bodies in their normal condition, the opposite forces or electricities being balanced and united, no attraction for neighboring particles exists, but when these forces are separated, as in the case of a Leyden jar, the attraction which a given quantity of electricity exerts for the similar amount of negative on the opposite coating, will be less in proportion to some law as the thickness of the dielectric intervening is increased.

It was therefore assumed that the amount of free attraction under these circumstances, or more correctly the amount of induction which would be thrown upon neighboring bodies, would increase inversely as the attraction between the opposite coatings diminished.

The apparatus made use of was constituted in the following way:—A glass pillar, varnished, for better insulation, was mounted upon a board. On the top of this a brass plate was attached, and upon this plate the dielectric to be examined was laid. Over the dielectric another brass plate was then placed.

A Leyden arrangement was thus constructed, the upper and lower brass plates representing the inner and outer coatings of an ordinary Leyden jar.

A brass ball, suspended from a balance which had an adjusting arrangement, so that it could be raised or lowered, hung over the upper metal plate at a short distance from it.

The *modus operandi* was as follows:—The upper brass plate was connected to the earth, and a series of sparks, through the medium of a sliding rod kept at a fixed distance from the prime conductors of a frictional machine, thrown into the lower brass plate of the Leyden arrangements, or the prime conductor was kept fully charged, and a

carrier ball attached to a long glass rod was made use of to measure out definite quantities of electricity.

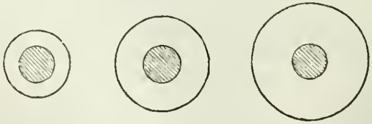
The room in which the experiments were performed, was heated with a stove, and the dryness of the atmosphere indicated by a hygrometer, so that the insulation might be as perfect as possible. When a certain number of sparks had been thrown into the lower brass plate, the upper brass plate was disconnected from the earth, and the lower one attached to the balance, and if the tension of the charge was sufficient, the brass ball suspended from the balance was attracted down, and discharge ensued. The experiment was repeated again and again, and the number of sparks requisite to just attract the ball down, noted.

Glass plates were the dielectric employed, and the experiment was tried first with one plate, then with two, and then with three plates of glass between the upper and lower brass plates, the brass ball suspended from the balance being kept always at a certain fixed distance from the upper brass plate.

The results obtained from a numerous series of experiments were—that when two plates of glass were placed between the brass plates, only half the number of sparks which were required to raise the tension of charge sufficiently to cause discharge when one plate of glass separated the brass plates was requisite, and when three plates of glass divided the upper and lower brass plates, then a third of the number of sparks raised the charge to the same degree of tension, showing that through flat plates of glass, induction decreases in the inverse proportion to the thickness of the dielectric, that is to say, if the induction through one be 12, through 2 it will be 6, through 3—4, and so on.

In the case of a gutta-percha covered wire, it was anticipated that as when the thickness of the gutta-percha is increased, the outer surface increases at the same time, the decrease of induction consequent on the increased thickness of the insulating material would not be inversely proportionate to the depths of the gutta-percha, but would follow some other law. To put this to the test, a series of Leyden arrangements were constructed in the following way: three pieces of tube, of half an inch internal diameter, and 2 feet 6 inches long, were placed in the centre of tubes of 2 feet long, the internal diameters of which were 1 inch, $1\frac{1}{2}$ inches, and 2 inches, and the space between the inner and outer tubes filled with melted resin. (Figs. 1, 2, 3.)

Fig. 1. Fig. 2. Fig. 3.



By this means three Leyden arrangements, with a uniform internal surface, but whose insulating material varied in thickness in the pro-

portion of 1, 2, and 3, were constructed, and the same process as that already described with the flat plates was repeated.

The results obtained are shown in the annexed table:

Diameter of Inner Tube.	Thickness of Insulation.	Diameter of Outer Tube.	Inductive Force.
10	5	20	22
10	10	30	15·5
10	15	40	11·5

These results were very constant, but as resin was the only dielectric employed, the experiment requires repeating with other dielectrics, for there is reason to believe that with glass at least the decrease in induction consequent on an increased thickness of the dielectric would be somewhat greater than that indicated in the above table.

The reasons for this belief are the following:—When a galvanic battery is connected with the inner and outer coatings of a Leyden arrangement, induction will take place through the dielectric, and if the surfaces of the two coatings are equal, then the force will be equally divided over them; that is to say, if the battery force be 100, the tension of the charge on the one coating will be 50, and that on the other will be 50 also, =100.

Let the surface of the outer coating be supposed to be infinite in extent, then the tension of the charge on the inner coating will be almost nil. An example of this we have when the earth represents one of the coatings of a Leyden arrangement; and this is the case in the prime conductor of a frictional machine, and also in the suspended wire of a telegraphic circuit; in these two examples the prime conductor of the machine and the wire of the telegraphic circuit represent the one coating, the air the dielectric, and the earth the other coating.

Now consider a case where the outer surface is double that of the inner one, the tension of the charge on the inner coating will then be double that of the *outer;* an example of this we have in the above table, where the inner surface is 10, the thickness of the insulation 5, which may here be regarded as unity, and the outer surface 20—the battery force being 100. Divide this into three parts, and we get $33\frac{1}{3}$. Give two parts for the tension of the charge on the inner coating, and one part for the tension of the charge on the outer coating, then we shall have for the tension of the inner surface, $66\frac{2}{3}$; for the outer surface, $33\frac{1}{3}$, =100 when united.

Now, consider the third example in the above table. Inner surface 10, thickness of insulation 15, outer surface 40, or quadruple that of inner surface. In this case the tension of charge on the inner surface will be four times that of the charge on the outer surface. In other words, the tension of the charge on the smaller surface will be 80, and that of the outer surface 20, the united tensions equaling 100; but the thickness of the insulation is 15, or three times that of the first example; and it has been shown that induction decreases in the in-

verse proportion to the thickness of the insulating material; we shall, therefore, have to divide by 3, and this will give 26·6 for the tension of the charge on the inner surface.

In the first example it has been shown that if the force be 100, the tension of the charge on the inner surface will be 66⅔, which, to avoid fractions, we may regard as 67. In the actual experiment the inductive force measured was 22; 67, therefore, represents 22, and as 67 is to 22 so should 26·6 be to the amount of force which would be expected to be obtained in the last example; this, when calculated by a simple Rule of Three sum, gives 8·8 for the amount of inductive force. In the actual experiment the force obtained was 11·5, a result, therefore, sufficiently near to warrant further investigation, to ascertain whether the law which would seem to be indicated is correct, and whether it holds good with any other dielectric, such as glass, in which case the cause of the discrepancy, when resin is the dielectric employed, should be sought after.

I now proceed to conduction.

The law which governs the conduction of electricity has been very accurately ascertained, and would seem to follow the same law as induction, that is to say, if the sectional area be uniform throughout, the resistance which a conductor will oppose to the passage of a current will be directly relative to its length; or, the length of the conductor being determined, the resistance will be relative to its sectional area. In other words, a wire one mile long will oppose half the resistance of that which will be opposed by a similar wire two miles long; and two wires, each two miles long, placed side by side, which is the same thing as one of twice the sectional area, will oppose exactly the same resistance as a single wire one mile long.

The next thing to be considered is the part which the quantity and intensity of electric currents play in electric phenomena.

The amount of force developed by an electric current, whether it be the deflexion of a needle, the attraction of an armature in an electromagnet, or the decomposition of water, is always relative to the dynamic quantity flowing.

This fact has been well established, and the difference between quantity and intensity accurately defined; yet still, in practice, there is a want of a clear comprehension of the relationship of those terms.

Let a battery—say of ten pairs of elements, with ten inches of surface in each cell—be joined through a circuit perfectly insulated, and opposing very great resistance to the passage of the current, and the amount of force, or in other words, the dynamic quantity of electricity flowing, be weighed off by a magnetometer, and noted down. If now this battery be disconnected, and another of the same number of elements, but with twice the surface, be connected in its place, practically no more will be found to be flowing through the circuit than in the former case, the resistance which the wire opposes measuring out the quantity passing somewhat in the same way as the height of the column, and not the quantity of water in a cistern, regulates the rate at which it flows from an orifice inserted in it.

Let the series be increased, and more will be urged through; and, if the number of cells be sufficiently numerous for practical purposes, the same dynamic quantity as a single cell would generate through a circuit of no resistance, will be found to be flowing.

In theory this point can only be approached, for the resistance of the wire can never be completely overcome. In theory, also, when the number of elements is not increased, the larger the surface the greater will be the dynamic quantity flowing, for the tension of the current is lowered in proportion to the amount of electricity flowing out of the battery; and, when drawing from a larger reservoir, which batteries of greater surface may be compared to, this same amount will not lower so much the general tension; consequently, there will be more intensity to urge the current through. But to return to practice. If the number of cells has been sufficiently extended so as to generate the same dynamic quantity as a single cell does through a circuit of nominally no resistance, a further addition to the series will not be attended with any beneficial effect, for there is already power enough to urge through all the electricity the battery is capable of generating; and the force developed is directly relative to the dynamic quantity flowing. Tension is only the medium by means of which this dynamic quantity is forced through the circuit.

It will be as well, perhaps, to define more precisely what is wished to be understood by the term resistance. When it is said that one circuit opposes twice the resistance of another, it is meant that the same tension of current will force half the dynamic quantity only through this circuit that it would through one opposing half the resistance; it follows that a given length of wire opposes the same resistance to half the dynamic quantity of electricity that half this length of wire does to double the dynamic quantity, and hence all circuits oppose to an infinitely small quantity of electricity an infinitely small amount of resistance.

The way in which quantity and intensity affect practical telegraphing has next to be considered, and whether there be any advantage in employing comparatively large over smaller dynamic quantities of electricity.

It may be generally stated that when the insulation is very perfect there is no great difficulty in working with minimum quantities; but when the insulation is imperfect, larger dynamic quantities hold out a better prospect of working through.

When a current is flowing through a circuit which offers, practically speaking, no resistance, let the cells of the battery be ever so numerous, it will possess no intensity worth noticing, for, as there is no resistance opposed to the force resident in the battery, the intensity is not brought into play. It is something like a powerful engine raising a light weight, the force is latent, but not brought into action.

Let the battery, however, be connected through a circuit opposing considerable resistance; its intensity will then be developed.

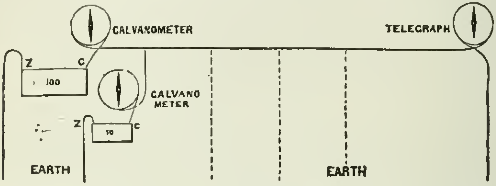
Let the diagram (fig. 4,) represent a circuit which fulfills these conditions, one end of the wire dipping into the earth in the usual way, and the other connected with the copper pole of a battery composed

of a numerous series of elements possessing very little surface, and, consequently, capable of generating only a small dynamic quantity of electricity, and let the circuit be completed by connecting the zinc pole to the earth.

The current will flow from the copper pole through the wire, thence to the earth, and back to the battery, and its working intensity will be dependent on the resistance which the circuit opposes, and can be measured in the following manner:—

Let another battery, but with a much smaller number of elements, be connected side by side with the larger battery to this wire, the zinc

Fig. 4.



pole being connected to the earth and the copper to the wire, and introduce galvano-meters in the circuit, between the large battery and the wire and between the small battery and the wire, so as to indicate the direction in which the currents are flowing.

Both batteries will desire to send a current through the circuit in the same way, but should the small battery oppose much less resistance to the passage of a current through itself than is opposed by the long wire, then the greater quantity of electricity generated by the large battery will pass that way in preference to through the wire, and paralyze the action of the smaller battery; but if cell after cell be added to this little battery, when its intensity becomes greater than the resistance of the wire, a current will flow from it also in the same direction as that from the large battery through the wire, and the number of cells requisite just to do this will be an exact measure of the working intensity of the current.

Let the case now be considered where the insulation is not perfect; if there be sufficient leakage to let the small dynamic quantity, which the battery can only generate, escape on the road, no appreciable amount will reach the further end, the tension of the current will be lowered, and a less number of cells in the little battery will now be found to balance it.

Adding to the number of these small pairs of elements will not give any appreciable assistance, but let the surface in each of the cells of the larger battery be increased so that a greater quantity may be generated than can escape through the leaks, represented in the diagram by the dotted lines, an appreciable amount will then reach the further extremity, and the telegraph instrument be rendered active. In such a case as this, adding quantity will raise the working intensity of the

current, whilst increasing the intensity of the battery alone will scarcely affect it.

In some experiments tried by my brother, Mr. Cromwell Varley and myself, on long leaky circuits, increasing the surface of the batteries alone, without adding to the series, raised the deflexion on the galvanometer from 22° to 53°; and the last intelligible words uttered by the Atlantic cable, "Daniells are now in circuit," is a further testimony of the correctness of what has just been advanced.

(To be Continued.)

For the Journal of the Franklin Institute.

Fog Signals by Sounds.

Musical phrases are used in armies to direct the movements of men, but no advantage is taken of them to convey information beneficial to vessels navigating in a fog or on dark nights. We have steam whistles, bells, gongs, and horns, to make unmeaning noises. Why cannot a regular system of phrases or sounds be introduced showing which way a vessel is heading to avoid collision, &c.? Only two musical intervals would be required, say an octave or a fifth, to communicate any information wanted. When it has been suggested, the reply has been, "we do not understand music." A knowledge of music is not necessary; when we hear the sound of the bird whistling "Bob White," we know what bird it is, and this interval, alone, introduced on board of our river steamers would be invaluable; for "Bob White" being the upward bound craft, and "White Bob," or the descending interval, the downward, they could port their helms or stop their engines, as circumstances required. E. B.

Brooklyn, April 14, 1859.

The suggestion of our correspondent, simple as it is, or rather on account of its very simplicity, is well worthy of attention. It is not necessary to insist on the necessity of some kind of signals to avoid collisions, and the constantly recurring record of such accidents in our newspapers shows pretty conclusively that those at present in use are insufficient. In fact, nothing but absolute necessity could justify the apparent absurdity of having recourse to sight-signals to avoid accidents arising from the want of power to see. But the circumstances which deprive us of the use of our eyes, exert no power over our ears; and it is very easy to arrange signals by sound which may tell all that we want to know. The direction of the sound can be made out with sufficient ease and accuracy to prevent running into its origin; and the properties of sound, the differences in tone, in duration, and in loudness (even those of quality might, if necessary, be used), will give us a very large number of signals capable of being heard at great distances, and of being distinguished by the dullest apprehensions. The two signals suggested by our correspondent, for instance, consisting of a low short sound, followed by a high and long one, and the reverse, are sufficient to indicate the direction in which a vessel is

heading—and as the direction in which she lies at the moment is known, these are all that are in most cases wanted.

If any one doubt the feasibility of such uses, let him take one of the small steamers that run along the coast of Maine, between the islands and the main—a coast infested in the summer by almost continued fog—and see how rapidly and accurately the position of land or vessels is determined by the echo of the steam whistle; and we do not doubt that he will come back convinced of the possibility and utility of such signals. ED.

For the Journal of the Franklin Institute.

Particulars of the Steamboat John Brooks.

Hull built by John Englis. Machinery by Allaire Works, New York. Intended service, New York to Bridgeport, Connecticut.

HULL.—		
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		250 feet.
Breadth of beam at midship section,		34 "
Floor timbers—molded, 14 inches—sided, 11 inches.		
Frames—apart at centres, 26 inches.		
Depth of hold,		11 "
" to spar deck,		11 "
Draft of water at load line,		7 "
" below pressure and revolutions,		7 "
Tonnage,	900.	
ENGINE.—One—Vertical beam.		
Diameter of cylinder,		56 inches.
Length of stroke,		12 feet.
Maximum pressure of steam in pounds,	40.	
Cut-off,		8 "
Maximum revolutions per minute,	22.	
BOILERS.—Two—Return flues.		
Length of boilers,		26 feet.
Breadth "		10 " 6 inches.
Number of furnaces,	3 in each.	
Breadth "		43 × 36 inches.
Length of grate bars,		7 feet.
Number of flues,	24.	
Internal diameter of flues,		21, 14 and 13 "
Diameter of smoke pipe,		4 feet 6 "
Height "		40 "
Description of coal,	Anthracite.	
PADDLE WHEELS.—		
Diameter,		34 feet.
Depth of blades,		22 inches.
Number "	28.	

Bronze of Aluminium.—Letter of M. Christofle to M. Dumas.

We have applied the aluminium-bronze to two uses for which its qualities of hardness and tenacity appear usefully applicable, and success has answered our attempt. The first is the manufacture in this

bronze of axle-bearings, and rubbing surfaces for machines. We give as examples:—

First, An axle-box which was placed on a polishing lathe making 2200 turns per minute; it lasted for nearly eighteen months; other boxes in the same condition do not last over three months.

Second, A carriage for a circular saw, making 240 turns per minute, which has lasted for a year without an apparent trace of wear; the carriages in common bronze do not last more than four months.

The second application is the employment of this bronze in the manufacture of guns of all kinds. We made a pistol-barrel, which, after having been tried at Paris, was afterwards at the Exhibition at Dijon. It underwent the tests in presence of the jury, and answered perfectly our expectations. We are aware that these experiments cannot be conclusive as to its application for artillery; but the comparative experiments which we have made with this metal, bronze, iron, and steel, have shown the immense superiority over those different metals.

The bars may be worked hot as easily as the best quality of steel.—*Academy of Sciences of Paris.*

(The bronze here spoken of, is formed of 90 or 95 parts of copper, and 10 or 15 parts of aluminium. ED. JOURN. F. I.)

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*Destructive Effects of Red Lead upon Iron.**

Mr. Robert Lamont, who was, a few months back, requested by the managers of one of the largest steam packet companies in the kingdom to make a report on the merits of certain compositions used to a large extent in Liverpool for the preservation of iron ships, and to prevent fouling on the bottoms of such vessels, has come to the conclusion, so far as regards the use of red lead, or paints containing lead, quite at variance with the popular notion upon the subject, by declaring the use of that pigment for coating iron vessels to be most pernicious. And in this hypothesis he is confirmed by the opinion of Mr. Nathan Mercer, F. C. S., who, after inspecting the iron ship *William Fairburn*, the plates of which were coated with red lead prior to her late voyage to Calcutta, observes that the extent to which the iron had been corroded could not fail to have attracted the attention of the most superficial observer. On a close inspection he found the red lead coating covered with blisters, from each of which, on being opened, a clear fluid escaped, and left exposed on the surface of the iron a number of brilliantly shining crystals of metallic lead. Mr. Mercer says each blister is, in fact, a galvanic battery in miniature, and that, as wherever there is electrical there must be also chemical action, the corrosion is easily accounted for. This action, he says, will continue as long as any red lead remains, and is necessarily at the expense of the iron. He also points out that the "sweat," so well known to every person interested in iron ships, is not, as is generally supposed, salt water, but a solution of chloride of iron manufactured in the blisters. Mr. Mercer considers this sweating is due, in a great degree, to the

* From Herapath's Journal, No. 1037.

use of red lead paint in immediate contact with iron; and he recommends, therefore, that it should never be used as a coating for sea-going vessels, unless special precautions are taken to prevent its coming into direct contact with the iron.—*Liverpool Albion.*

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*Water Boiled without Fuel.**

It had always been considered that water presented an exception to the rule observed to hold in other bodies—namely, that their temperature could be raised by friction or percussion, until Mr. Joule showed that water manifested a sensible rise of temperature by a brisk agitation continued for some time. His range of temperature did not, however, we believe, exceed 2° Fahr. George Rennie, F.R.S., so well known in the engineering and scientific world by a pamphlet before us, has so improved on the experiments of Mr. Joule and others, as to have succeeded in raising the temperature of water by churning up to the boiling point 212° Fahr.

* From Herapth's Journal, No. 1022.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 16, 1859.

John C. Cresson, President, in the chair.

John F. Frazer, Treasurer, }
Isaac B. Garrigues, Recording Secretary, } Present.

The minutes of the last meeting were read and approved.

Letters were read from the Superintendent of the Geological Survey of India, and the Geological Museum, Calcutta, India; the Regents of the University of the State of New York, Albany, N. Y.; the Union College, Schenectady, New York; the Massachusetts Charitable Mechanics' Association, Boston, Mass., and the University of Michigan, Ann Arbor, Michigan.

Donations to the Library were received from the Royal Society, and the Chemical Society, London; the Government of India, Calcutta, India; the Austrian Engineers' Association, Vienna, Austria; L. A. Huguet-Latour, Esq., Montreal, Canada; the State University of Michigan, Ann Arbor, Michigan; the Proprietors of Locks and Canals on the Merrimac River, Lowell, Massachusetts; the Chamber of Commerce of New York: B. H. Latrobe, Esq., and the Board of Commissioners of Public Schools, Baltimore, Maryland; the New Orleans School of Medicine, New Orleans, Louisiana; the American Philosophical Society, and Professors John F. Frazer and John C. Cresson, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of May.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (7) were proposed, and the candidates (6) proposed at the last meeting were duly elected.

A. Stone & Co., sent to the meeting for the inspection of the members a sample of the air-tight jars made by them, intended for the purpose of preserving fresh fruits. The jar is of glass, with a wide mouth, in which two projections are made at points opposite each other. The cover is also of glass, and is made with a screw upon the part that goes into the mouth; two openings are cut across the screw, so that the cover may be inserted in its position. On the cover, which extends beyond the mouth, are two projections for the purpose of turning the cover so that the screw will catch under the projections in the mouth, and draw the cover down tightly upon the edges of the mouth. To insure an air-tight joint, a ring of gum is placed under the cover before it is screwed down.

Mr. Eddy, artist, of this city, presented a beautiful specimen of his work in a cabinet size picture, of a lady. The impression was first taken by the crystalotype process, and that painted in with oil colors, thus making a picture possessing all the truthfulness of the daguerreotype, with the animation, durability, and softness of oil coloring. While possessing these additional advantages, so much less time is occupied than when the drawing is done by hand, that the pictures can be made at about one-fourth the usual cost of oil painting.

The rendering wheels used upon the planes of the Mine Hill Railroad. were shown in a model laid upon the table. The wire rope, used for hauling up the cars upon this road, winds upon these wheels, and bears upon wood set endwise, so that the ends of the grain are presented to its pressure. The wood is of oak, hickory, or such wood as will not wear rapidly or crush easily, but permit a sufficient indentation of the strands to prevent slipping. The wood is held between a flanch cast on one side of the face of the wheel, and a detached ring forming a flanch on the other side, and held up with bolts. By this arrangement, a piece of defective wood can be easily removed, and its place supplied with another. The wheels have been at work for some months, and are giving satisfaction by their performance.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on an Improved Protractor, invented by Charles Gordon.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination "an Improved Protractor," invented by Charles Gordon, of Washington City, D. C.,

Report:—That this protractor consists of a parallel ruler of the usual form, having attached to it a semicircle graduated to any desired division of the circle. This ruler is attached to a bar by a set-screw passing through the centre of the semicircle, so that the ruler can be clamped at any angle to the bar. A vernier and a reading glass facilitate this adjustment. The bar to which the ruler is attached forms part of a heavy plate of metal which is made in the form of a triangle,

having two of its sides at right angles to each other. The weight of the plate keeps the instrument in its place upon the paper, and by setting either of its sides to coincide with any given line upon the paper, any lines may be drawn making given angles with the first or meridian line.

It is especially intended for plotting from the field notes of a compass survey, and is, for that purpose, admirably adapted, since short lines making known angles with each other or with a meridian can be very accurately and quickly laid down. The difficulty of placing the centre of the protractor exactly over the point at which the angle is laid off, which is common to all existing forms, is not present in this arrangement, where the divided semicircle turns about a mechanical axis, and not an imaginary one.

The Committee recommend the instrument as very simple, and as exceedingly useful for facilitating many varieties of a draughtsman's work.

By order of the Committee,
Philadelphia, January 9, 1859. Wm. Hamilton, *Actuary.*

BIBLIOGRAPHICAL NOTICES.

Geological Survey of Canada. Sir W. E. Logan, F. R. S., Director. Figures and Descriptions of Canadian Organic Remains. Decade III. Montreal, 1858. 2000 copies issued, of which 500 are reserved for the Legislature, and the remainder sold at a moderate price.

This pamphlet of 100 pages with eleven plates, consists of First, a Preface by Sir W. E. Logan, Director of the Geological Survey of Canada; 2d, a Memoir on the Cystideæ of the Lower Silurian Rocks of Canada, by E. Billings, Esq., F. G. S.; 3d, a Memoir on the Asteriadæ of the Lower Silurian Rocks of Canada, by the same; 4th, a Memoir on Cyclocystoides, a new genus of Echinodermata from the Lower and Middle Silurian Rocks, By J. W. Salter, Esq., F. G. S., of the Geological Survey of Great Britain, and E. Billings, Esq.; 5th, a Memoir on the Palæozoic Bivalve Entomostraca of Canada, By T. R. Jones, Esq., F. G. S.

Although called Decade III, this is the first published of a series of reports intended to illustrate the Palæontology of Canada and the northern border of the United States; new ground, and full of new and unexpected forms of ancient life; to the study of which, Mr. Billings brings an ardent zeal, a clear eye, nice analytical judgment, indefatigable diligence, and a lucid and agreeable style. He has, on this side of the water, the advantage of the friendship and co-operation of James Hall, whose collection and whose judgment are unsurpassed; and he has spent a sufficient time previous to the printing of this Decade, in England, in comparing his specimens with those in the collections of the Geological Survey of Great Britain, and his views with those of Salter, Ramsey, Murchison, Barrande, and other palæontologists of

Europe. We therefore hail the appearance of this beautiful little volume as the forerunner of an invaluable series.

Mr. Billings was appointed Palæontologist of the Canada Survey in 1856, and his first work was to arrange the museum at Montreal. It was in order and gave the liveliest satisfaction to the members of the American Association who had an opportunity of examining it at the Montreal meeting in 1857. Lofty cases round the rooms exhibit the larger specimens, and glass-covered tables occupying the central spaces cover piles of drawers, full of the treasures which we expect to see portrayed and described in these decades. Into the walls of the landing places in the staircase hall are set numerous huge slabs of sandstone on which are seen rows of foot tracks, upon ripple-marked surfaces, pitted with the marks of rain drops, scratched in compound lines by small crustaceans, or trailed over by aboriginal worms. Into this museum have been thrown for the last two years the very numerous contributions from the extreme east of Canada, Anticosta, and Newfoundland; and among them, a unique collection of those wonderful creatures, the Silurian Graptolites, to be described by Hall.

We are glad to learn from the preface of the Decade, that twenty-four species of these and allied genera from the Hudson river group, drawn by Meek, and engraved on steel by Gavit, will be given by Hall in Decade II, commenced in 1855. A preliminary description of these was published in the Report of Progress in 1857. Decade I was confided in 1855 to Salter, the well-known English palæontologist, and must by this time be in the printer's hand. Its plates are by Sowerby from drawings by Bone; and its object is to exhibit the commingling at one locality of forms heretofore supposed to belong to distinct epochs. We admire this fresh example of the fearlessness of true science. Palæontologists are disposed to slight the argument from lithological constitution and mineral sequence for identifying rocks over wide intervals, and to put their whole trust in the outspread and sequence of animal forms. Structural geologists, on the other hand, are too tenacious of mere color and composition as sufficient clues to lead inquirers through the maze of broken ground. Every discovery of a fossil genus or species fixed at one horizon, and not discoverable above or underneath it, is a blow given to structural bigotry; and conversely, every discovery such as the one described above, to be presented in the first Decade of the Canada Survey, of a mixing up of earlier and later forms in the same bed, or in a known cotemporaneous deposit, is a still harder blow given to the still more mischievous bigotry of the mere palæontologist. But when a man is found, who is both a structural and a fossil geologist like James Hall or Sir William Logan, science is allowed to speak for herself, and then she harmonizes all.

The Decade before us gives us beautiful and copious delineations of a class of extinct forms which has of late excited a new interest. In the order of forms, the cystideans come between the fixed stone-lilies, encrinites, &c., and the floating trilobites; some are flat and some are round, globular or ovoid, and even cylindrical, but they all remind the spectator at once of the trilobite, and of the encrinite. Their lowest

forms had a hard tesselated back on one side, and a flexible and also tesselated, or we may almost call it, shagreened calcareous belly on the other side; and they were supported on a sort of tapering stem tail, composed like the foot-stalk of the stone-lilies, of numerous joints. At the apex waved two tapering jointed horns or arms, and certain small holes or slits, noticeable between the horns, or notched into the edges of the back plates, are considered by Mr. Billings to have been both mouth and anus. Some of these lower forms resemble the head of a viper, especially on the under side. As we ascend in the scale, the cystid becomes very beautiful, sculptured with radiating ridges and mathematical figures, and crocketed like a gothic pinnacle along the edges. This effect is produced by the falling of the arms down against the body. Some of the species have no arms at all as seen in the fossil condition, but are grooved from the summit downward, showing where their flexible, soft, and perhaps gelatinous arms originally lay. Some of these *Glyptocystites* are models for a designer. Still higher in the scale we find globular cystidæ, pitted like strawberries, (*comarocystites*,) or elongated like almonds, (*amygdalocystides*,) and adorned with arms which are themselves armed so that these creatures appear to have waved flexible stony plumes before them. The pits are sunk like the rosette panels in the vault surface of St. Peter's, and are exquisitely sculptured. In the apple-formed *malocystites* these plumed arms fall against and ramify over the globe, covering it with a charming net work.

For the internal structure of these curious beings, and the way they reproduced their young, along their arms like starfish, or in the manner of ferns in the vegetable kingdom, we must refer the reader to the text of Mr. Billings.

That the cystidean idea passes up into that of the starfish, is evident at a glance at the plates which illustrate Mr. Billings' paper on the Asteriadæ. Plate VIII shows us globular forms of tesselated stony matter with five arms tightly bound down upon the surface; arms which bear a perfect general likeness to those of a starfish of the present day. Plate IX shows the whole globe absorbed into the five arms, and Plate X gives still further developed forms of the most elegant character, in which the arms exist alone like expanded flowers. Plate XI exhibits the last and strangest metamorphosis of all, in which the arms sink back upon a disc like a half dollar, with tracery radiating from the centre to the ornamented edge, and bifurcating again and again like a brilliant design for a cathedral rose window. We recommend to Hunt or Notman the figure 5* b Plate X for the next great rose window they require.

Murchison in his last edition of the Siluria, London, 1859, gives on page 245, a number of small cuts of the cystideæ of the Wenlock limestone, (Upper Silurian,) one of which, *Pseudocrinites magnificus*, might have been called quite as appropriately *horridus* or *caput medusæ*, for it is entirely surrounded by waving matted stony locks of arms.

The subject leads us directly into that world of late investigation, the Crinoideæ, of which the two volumes of the Iowa Survey just pub-

lished by Hall, and the third volume of the Kentucky Survey published last year by Owen, furnish the freshest illustrations. We will speak of these hereafter. L.

The Chemistry and Metallurgy of Copper, including a description of the principal Copper Mines of the United States, &c., &c. By A. SNOWDEN PIGGOT, M. D., Philadelphia : Lindsay & Blakiston, 1858.

This duodecimo of 388 pages is one of those complete little manuals which the practical genius of modern science has been furnishing of late years to the mere working world, and the value of which cannot be estimated except by the necessities of those who find themselves involuntarily consulting them upon all occasions. A few paragraphs and a few wood-cuts on this or on that question, to elucidate this or that difficulty, are very little to the reading or even to the thinking world, but are everything to the student, who blesses every stray ray of light, and to the workman wondering where the man lives who was ever troubled as he is, or who can show him the way out of his perplexities. If the present age differs from preceding ages in any trait of its life form, this may be stated as its characteristic difference, that it sums up, states curtly, and illustrates clearly, the practical scientific materials, provided by the past and perfected by the present, for every employment of man, in its hand-books for every country, science, and art. The book before us has seven chapters: the first devoted to the chemical relations of copper, the second to the ores, the third to their analysis, the fourth to mines and mining in general, the fifth to copper mines in particular, the sixth to copper smelting, and the seventh to the alloys of copper used or useful in the arts. The chemical compounds of the metal are given, therefore, in two forms, first as they are produced or reduced in the laboratory, and then as they appear in the great laboratory of the earth-crust in three of the four classes of copper ores, native copper constituting a first class by itself. The other three classes are the oxides and chlorides, the compounds with sulphur, selenium, arsenic, and antimony, and the numerous and heterogeneous compounds of copper with the remaining elements. It is curious to see how almost exactly sulphur and oxygen replace each other in their alliance with copper; normal copper glance being 79·8 Cu + 20·2 S, and 79·86 Cu + 20·13 O being normal black oxide. In a geological point of view, the most important ore of copper is the pyrites or double sulphuret of iron and copper, 34·47 Cu + 30·48 Fe + 35·05 S = $Cu_2\,S + Fe_2\,S_3$. This mixed with the red oxide forms the ore described on page 275.

The analysis and assay of copper ore are fully treated in 52 pages. Chapter third contains 50 pages on general mining, in which the author states and illustrates his views of the formation of mineral veins, and evidently leans to the theory of *lateral secretion.* The fourth chapter describes the geographical distribution of copper ores ; first, in the old world and South America, and then more elaborately in the Lake Superior region, the Mississippi Valley region, and the region of the

Atlantic States, after the arrangement of Whitney. Twenty pages are devoted to these three regions. The table on page 241, brings the yield of the East Cliff mines down to 1855, and the dividends of the Company to 1856. The table on 249 brings down the yield of the Minnesota also to 1855, and we notice that this is about the limit of statistical information, as to time, in this section. Every mine opened at that date is mentioned and described more or less in detail. The Silurian ores of Wisconsin and Missouri deserve and receive but a slight mention. Dr. Piggot then begins at Maine, and descends the Atlantic seaboard to Georgia, noticing chiefly the copper lodes of Virginia and Eastern Tennessee, and ending with the copper mines of the New Red Sandstone of New Jersey and Pennsylvania. In some cases the statistics come forward to 1857, and important modifications of the first opinions formed of some of these exhibitions of copper are shown by subsequent experimental work to be necessary. We point to the Manasses gap mine as a warning, how needful a proper examination and method of attacking a vein is, to justify proceedings upon even the best chemical analysis of hand specimens. Veins lately discovered in the same neighborhood, and with even a finer show of copper than the Manasses gap outcrop made, will lead to the same results unless due care be taken to insure preliminary knowledge of the ground.

The fifth chapter on smelting copper, gives in great detail (from Muspratt) the English process pursued at Swansea, with cuts of furnaces and descriptions of the ten successive operations. Then the patent processes of Napier, Brankart, Rivot & Phillips, Davies, Birkmyre, De Sussex, Low, &c., with the objections to them; the French method pursued at Chessy, near Lyons; and finally, the smelting of the Mansfield copper schists in Germany, with pictures of the apparatus.

The last chapter on the practical alloys, and the Appendix of tables of statistics, are of considerable interest to the general reader, and advance the statistics of the production of Cornwall to 1857. L.

The Iron Manufacturer's Guide to the Furnaces, Forges, and Rolling Mills of the United States, with discussions of Iron as a Chemical element, an American ore, and a manufactured article, in Commerce and in History. By J. P. Lesley, Secretary of the American Iron Association, and published by the authority of the same, with maps and plates. New York: John Wiley. London: Milner & Co., 1859. 8vo., pp. 772.

As indicated by its title, and more fully in its preface, this work is intended as a manual of important information to every one concerned in the manufacture or use of iron. It divides itself naturally into two parts. First, a directory intended to give the location and general statistics of all iron works in the United States and Canada, classified as furnaces, forges, and rolling mills. This portion, which has required great labor and perseverance in acquiring the information thus communicated, occupies 262 pages, and is illustrated by four maps;

two of which are very good specimens of the new process of photography as applied to lithography. This valuable mass of information for every one in any way concerned in the use of iron, is due to the enterprise of the American Iron Association, a company which has done much valuable service to the arts and industry of our country, and deserves the encouragement of every American. The second part of the book consists of a practical treatise upon iron, and its ores. The treatise on iron as a chemical element will be found to be a very carefully elaborated digest of almost every thing of value which has been written upon iron, since its great importance has been recognised. The account of the ores is divided into chapters on the primary ores, the brown hæmatite, the fossil ore, the carbonates, and the bog ore; and under each head are given the principal localities, the mode in which the ore lies, and its gangues; the theory of its occurrence, the modes of working it, and the results of these various methods so far as they can be reached. This portion will be found of great interest not only to the practical iron worker, but to every one who takes an interest in the natural history of our country, and especially to the geologist and mineralogist.

The third and fourth divisions have been pressed out by want of space, and will form the subject of a subsequent publication. They include the discussion of iron as an American manufacture, and in American history. Some twenty pages are, however, occupied with the statistics of the manufacture as collected by the Association, and the results are, as far as possible, digested in tables which give much valuable information upon this, the most important branch of our manufactures.

It is not our intention now to discuss the peculiar theories of Mr. Lesley, or of the authors whom he quotes with approbation—but to express our high approbation of the intelligence, zeal, and perseverance which are indicated in the preparation of this work, and to recommend it, and the subjects of which it treats, and the Association under whose auspices it is published, to the familiar attention of our readers.

ED.

Conservatory Journal; devoted to establishing a Massachusetts Conservatory of Arts, Science, and Historical Relics.

The gentlemen of Boston who feel an interest in the education and elevation of the people, have determined to establish in their city an institution similar to the Zoological Garden of London, and the Jardin des Plantes of Paris. The newspaper whose title we give above, is devoted to the furtherance of this object, and undoubtedly in a city so famous for the liberality and public spirit of its citizens, their efforts will be successful. Such a project has been smouldering in our city for years, but is not likely ever to rise above an *eremacausis.* We hope our neighbors will show us the way, and compel us to follow.

F.

Abstract of Meteorological Observations for April, 1859; made in Philadelphia, Somerset, Dauphin, and Centre Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

1859.	PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.								
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds
April.	Mean.	Mean daily range.	Mean.	Daily oscillation	Mean daily range.	2 P. M.	2 P.M.		
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.	Direc.
1	30·010	·214	50·7	23	3·2	24	·126		(var.)
2	29·878	·132	51·3	20	4·7	30	·201	} 0·294	(var.)
● 3	29·457	·421	57·7	18	6·5	83	·478		(var)
4	29·547	·096	48·0	14	9·7	22	·006		W.
5	29·624	·077	40·8	11	7·2	40	·124		W N W
6	29·731	·107	42·3	19	4·5	24	·055		W N W
7	29·757	·010	47·5	20	5·2	26	·109		S W.
8	29·800	·092	41·3	6	10·5	81	·194	0·100	N W.
9	30·068	·268	42·0	18	8·0	30	·102		N W.
☽ 10	29·971	·097	43·8	8	3·5	54	·169		N E.
11	29·587	·400	45·0	8	2·8	85	·297	0·949	(var.)
12	29·754	·167	49·2	15	6·7	74	·308		(var.)
13	29·781	·027	54·7	15	5·5	71	·382		S W.
14	29·639	·142	45·0	7	0·7	92	·265	0·996	E.
15	29·572	·067	50·3	23	10·0	40	·215		S W.
16	29·565	·110	47·7	11	8·7	32	·116		W.
○ 17	29·714	·149	46·5	15	4·8	41	·159		W.
18	29·800	·086	49·2	14	2·7	29	·130		N W.
19	29·745	·095	51·0	15	1·8	42	·202		W.
20	29·724	·039	53·3	16	2·3	28	·139		W.
21	29·649	·074	57·8	17	4·0	48	·300	0·213	S W.
22	29·483	·166	49·8	6	7·5	79	·301	1·775	S E.
23	28·999	·484	44·7	7	5·2	55	·178	0·096	(var.)
☾ 24	29·614	·615	50·7	22	8·0	28	·139		W.
25	29·743	·130	61·3	25	10·7	40	·292		S W.
26	29·683	·061	63·3	19	3·3	50	·389	0·065	S S W.
27	29·683	·073	54·2	4	19·5	86	·348	0·180	N N E.
28	29·890	·207	48·5	11	6·7	33	·143		N E.
29	29·829	·081	56·6	25	7·3	24	·147		(var.)
30	29·744	·085	64·7	33	8·3	22	·214		N N E.
Means	29·701	·160	50·3	15½	6·3	47	·212	5·668	N 68½ W

1859.	SOMERSET, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.						HARRISBURG, Dauphin Co. 40° 16′, N. 76° 15′, W. JOHN HEISELY, M D., Obs.				FLEMING, Centre Co. Lat. 40° 55′ N. 77° 53′ W. Ht. 780 ft. S. BRUGGER, Obs.		
	Bar.	Ther.	Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds	Bar.	Ther.	Rain and Snow.	Prevail'g winds.	Ther.	Rain and Snow.	Prevailing Winds.
April.	Mean.	Mean.	2 P. M.	2 P.M.			Mean.	Mean			Mean.		
	Inch.	°	Per ct.	Inch.	Inch.	Direc.	Inch.	°	Inch.	Direc.	Inch.	Inch.	Direc.
1	27·807	41·3	52	·242		W.	29·947	51·7		N W.	45·0		N W.
2	27·552	47·7	59	·249	0·084	S E.	29·746	52·3		S E.	48·0		S E.
● 3	27·272	53·7	48	·241		W.	29·325	54·3	{ 0·067	(var.)	54·3	0·200	(var.)
4	27·348	35·0	51	·142		W.	29·456	46·7		N W.	37·0		(var.)
5	27·346	28·7	77	·134	0·069	W.	29·552	39·7		N W	32·7		N W.
6	27·551	35·0	54	·149		W.	29·676	43·3		N W.	36·0		N W.
7	27·518	43·7	52	·212		W.	29·620	50·3		W.	44·0		(var.)
8	27·614	34·3	83	·221	0·240	W.	29·748	43·3		N W.	37·0		N W.
9	27·808	33·7	60	·172		S E.	30·019	43·0		N W.	41·3		(var.)
☽ 10	27·556	39·3	91	·234	0·656	S S E.	29·835	42·7		S E.	40·0	0·920	S E.
11	27·256	59·7	66	·502	0·140	(var.)	29·461	46·7	1·371	E.	49·3	0·190	(var.)
12	27·538	61·3	54	·442	0·068	W.	29·657	54·3		S.	57·0		N W.
13	27·567	60·7	82	·570	0·057	W S W.	29·679	62·0		S.	61·3		S E.
14	27·307	57·7	75	·529		S S E.	29·498	50·7	1·410	E.	51·0	0·550	(var.)
15	27·250	49·7	49	·255		S W.	29·403	51·7		S.	50·7		(var.)
16	27·380	36·3	72	·173	0·085	W.	29·503	46·0		N W.	30·3		N W.
○ 17	27·499	31·3	74	·199	0·121	W N W	29·625	47·3		N W.	42·3	0·030	(var)
18	27·642	39·7	66	·257		W N W	29·763	48·7		N W.	30·7		(var.)
19	27·589	43·0	61	·255		W.	29·720	48·3		W.	46·0		N W.
20	27·539	39·3	86	·210	0·273	S E.	29·664	52·0		(var.)	49·7		(var.)
21	27·398	55·3	56	·397	} 0·890	W.	29·536	57·3		(var.)	55·3		N W.
22	27·197	48·3	89	·328		(var.)	29·364	52·0		S E.	51·0	1·500	S E.
23	26·973	34·3	00	·199	1·588	W N W	28·869	44·7	2·012	N.	37·0	0·080	N W.
☾ 24	27·468	40·7	57	·199		W.	29·530	50·0		N W.	44·3		N W.
25	27·532	56·7	56	·397		S W.	20·659	57·3		(var.)	56·3		S W.
26	27·500	53·3	93	·390	0·252	S W.	29·582	61·0		S.	57·0	0·630	W.
27	27·458	50·0	96	·368	1·016	(var.)	29·596	55·0	0·674	N E.	48·0	0·200	E.
28	27·669	46·7	87	·362		(var.)	29·837	53·0		(var.)	48·3		E.
29	27·656	51·0	48	·300		E.	29·788	58·0		(var.)	54·0		(var.)
30	27·620	55·3	52	·368		E.	29·681	65·3		S.	59·0		S E.
Means	27·483	45·7	68	·290	5·539		29·611	50·9	5·534		47·0	5·200	

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1859.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Steam and its Condensation. By Thomas Prosser, C. E.

(Continued from Vol. xxxvii. page 365.)

CHAPTER VIII.

Comparative Results of Experiments made April 28th and May 3d, 1859, with other Experiments and Remarks thereon.

This Chapter is devoted to *Results* and their concomitants. And,

First. To the actual cost (in *coal*) of production of *steam* from water at 100° C. The grate and recipient heating surfaces, and the relative *weights* of coal employed.

Secondly. To the surface required for its condensation.

Thirdly. To its *abstract practical value*, irrespective of the means employed to make it available as a motor. If no one dreams of holding the *minter* responsible for the misuse of his manual coinage, why should another *minter* be held responsible for the misuse of his mental coinage? Enough for me to produce the steam and condense it economically, leaving to the mechanical engineer the responsibility of its application.

Steam has a fixed mercantile value, even as gold has, but it is far more liable to abuse; for all know the value of the latter, but few know any thing about the former as an article of merchandize.

Hence, I take no account (except incidentally) of the mere fact, that the *steam* in these experiments was actually used in a steam engine in the usual manner; but I must not omit the fact, that after having been so used, it entered the condensing apparatus perfectly dry, showing beyond all doubt, not only that there had been no priming, that no vesicular water had gone over with the steam; but also,

that there had been no condensation in the cylinder. When this has been done, all has been accomplished, which, in an economical point of view, superheating the steam admits of, although the advocates of the separate superheating ignore the fact, excepting the late Dr. Haycraft, who formerly belonged to that ultramontane party, but whose imitators do not appear to have attained one rational idea on the subject.

I shall institute, a comparison with my own, of the *evaporative effects* of two other boilers made and manned for the purpose, and shall show as conclusively as the case admits of, that no such immunity from priming, or going over of vesicular water with the steam, can be claimed for them, and therefore in comparing those boilers with mine, after making due allowance for the additional *total* heat in my steam as well as for its superheat, both of which operate equally in preventing condensation in the cylinder, my boiler is still compared with them at an unknown disadvantage, because it is impossible to divine how much *unconverted* water went over with their steam.

The proof offered is universal experience, which confesses that all ordinary boilers prime more or less, or carry over vesicular water with the steam. This point is too important to be passed over without further inquiry. Watt never knew what became of much more than half of the water which his boiler got rid of, at least he could only account for about that quantity as *steam*. The boilers of H. B. M. Steamer, the "*Bee*," took 1080 ℔s. of water from a tank, but only 580 ℔s.* were ever accounted for per indicator. The Manchester engineers, too, with the same system, have recently got out of their boilers 12·25 ℔s. of water for 1 pound of coal consumed. But the Admiralty engineers who were sent to examine into the matter, although they were "*witnesses*" who saw sights of 11·05, 10·97, and even 12·44 ℔s.† of water evaporated by 1 pound of coal, cruelly close their Report by observing that they "had some doubts as to the dependence that might be placed on the feed apparatus for the boiler, with reference to the exact quantity actually entering the boiler as measured to the feed apparatus and registered by the meter. Priming of the boilers was evidenced in an especial manner on the first and second day's experiments; it was not constant, but intermittent. Owing to these circumstances, we cannot place so much dependence on the accuracy of the results of the experiments as could be wished."‡

A very mild way, indeed, of intimating that the experiments were really of no value whatever, because the *palm* for evaporation must necessarily be given to the boiler which primed most.

What, then, are we to say to the reported evaporation of 15 pounds of water with one pound of coal? Not, certainly, that it is impossible; but it may just as well be made 20 or even 30 by *improving* the priming of the boiler; not that any of the ordinary multitubular ones are deficient in that *qualification*, by no means, but it is desirable to know how far it may be carried with a *pensive* public, so that we may as-

* The Indicator and Dynamometer by Main & Brown, page 31.
† Civil Engineer and Architect's Journal, April, 1859. page 122.
‡ See Mr. Isherwood's remarks. Also Journal Franklin Institute, Vol. xxviii, (3d Series,) page 262.

certain, not merely which feather broke the (humbug) camel's back, but the wretch who put it there. One would think, that a locomotive of *five hundred horse power** would do the job; but no, it won't, that has been tried and failed—make it camels then!!!

Is it not singular, that, of all the experiments made on the evaporation of water, there is not one recorded which shows, that any precaution had been taken against the water escaping, *unconverted*, with the steam? Few, indeed, take the trouble of recording any thing but the mere results, and for this you have only their *bare* word, which, in this matter-of-fact-age, is not of much account.

1st Report, 1844.

In the elaborate Report on the "*evaporative power*" of coals, made by Prof. W. R. Johnson, in 1844, by order of the Secretary of the U. S. Navy, the boiler employed was 30 feet long and 42 inches diameter, set in brick-work, with a furnace underneath it at one end, so as to expose 130 feet superficial to the action of the fire. Two 10-inch return flues containing 157 feet superficial within the boiler, brought back the products of combustion to the front over the furnace, from whence they escaped into the chimney stack, having been exposed to 287 feet superficial, of heating surface. But, by causing the gases again to traverse twice the length of the boiler, 90·5 ft. superficial more surface was obtainable, making 377·5 ft. superficial.

The grate had an area of 16·25 ft. $=(5\times 3{\cdot}25\text{ft.})$ being as 1 to 17·66, and 1 to 23·23 of the recipient heating surface, according as to whether the one or the other of the above described methods was adopted. The grate also admitted of a reduction so as to make the proportion as 1 to 33·18 and 1 to 36·68 respectively. The grate bars were $\frac{3}{4}$-inch thick and $\frac{1}{2}$-inch apart. The consumption of fuel per foot of grate surface did not exceed 8 pounds per hour, and the pressure of the steam was less than 7 pounds per square inch above the atmosphere.

The highest evaporative effect with one pound of coal was 10·7 lbs. of water from 212° F., the whole steam from which was thrown into the chimney, as well as the products of combustion from a small furnace, to improve the draft.

2d Report, 1848.

In the no less elaborate experiments on the "Coals suited to the Steam Marine," by Sir Henry de la Beeche and Dr. Lyon Playfair, in 1848, by order of the British Admiralty, the highest evaporative effect from one pound of coal was 10·75 of water from 212° F., but the steam was allowed to escape without note or comment into the open air.

The boiler employed was set in brick-work. It was 12 feet long and 48 inches in diameter, with an internal flue 30 inches in diameter, at one end of which the furnace was placed; from thence the products of combustion passed to the other end, and returned alongside the boiler on the outside thereof to the front again, where they descended and passed under the bottom of the boiler to the chimney, after having operated upon 197·5 ft. superficial of recipient heating surface.

* Got up on the supposition that the steam pressure in the cylinder is the same as that in the boiler, and ignoring the "blast," and back pressure which it causes on the piston.

The grate was 2·5 ft. × 2 ft., giving an area of 5 ft. The grate bars were ¾-inch thick and ½-inch apart. The grate surface was therefore as 1 to 39·5 feet of the recipient heating surface in the boiler.

The evaporation was about 80 lbs. of water to 1 foot of grate surface, which does not differ materially from the American experiments.

3d, My Boiler, 1859.

Now, my boiler differs in every conceivable respect from the two before described, for it has no grate properly so-called, but a hollow water-slab pierced with holes and short tubes expanded therein. The furnace is 17 inches square, and consequently has an area of 2 feet, on each foot of which, 16 lbs. of coal per hour was consumed, being about double the amount consumed on those before referred to, while the recipient water-heating surface is 100 feet superficial, with an additional 50 feet of steam superheating surface. This large superheating surface adds but little to the elasticity of the *steam*, but greatly to its safety, for inasmuch as the great immobility of steam, as well as of other gases, prevent rapid absorption of heat by them, a large surface is required, because limited to a low temperature on account of the danger attendant upon the reverse in the rapid corrosion of the boiler.

My boiler is of the upright multitubular kind, with tubular water leg furnace, hollow slab, and annular generator.

The condensing apparatus is of the slabannular kind, as shown by the colored plate attached to Chapter I, and with the boiler, has been examined by a Board of Engineers appointed by the Secretary of the United States Navy. The same Board have, as I understand, many reports to make on boilers and surface condensers* besides mine, which may thus cause some delay, and therefore I have thought proper, without anticipating their report on mine, to synoptisize a few of the facts elicited by those experiments, and principally such as will enable me to compare the "*evaporative power*" of my boiler with those before mentioned.

My boiler, be it remembered, has been in constant use more than two years, and on the trials did nothing but its ordinary every day work, while the others were new ones, I presume, and were certainly kept in special order for their work, and had philosophers to direct the firing.

The *modus operandi* adopted in the experiments will be understood by a reference to the colored plate before referred to, and the following observations.

[But previous to making them, I may be permitted to observe, that the tank method, or any other by means of which the water can be correctly measured into the boiler under examination, is the only correct preliminary to the obtaining of correct results, because, whatever may escape by steam leakage is just as much "evaporative effect" as that which is collected. Nay, even the water leakage of the *boiler* is so too, provided the heat from it dries it up and does not permit its collection.

* Why are not these reports, accompanied as they generally are, with correct drawings of the apparatus, published by the Secretary of the Navy? Some of them are invaluable. I may say, from the little that is known of them, that they are probably the most invaluable reports which our Government is in possession of on any one subject. Will not some of our Senators call them up, and redeem these invaluable papers from oblivion?

The main condenser was known to be much larger than necessary, inasmuch as the water flowing through it unchecked, would reduce the temperature so low as entirely to remove any pressure (above that of the atmosphere) in the exhaust steam pipe.

As no steam of any account would, under these circumstances, come from the bottom connexion of the main condenser with the reservoir, to interfere with the collection of the water of condensation therein, a cock was put into the reservoir at the same time that every other communication was cut off.]

The steam being allowed to leave the boiler and pass through the engine, deposited any oil, water, and any other substance heavier than steam in the "dirt trap." (NOTE.—The "dirt trap" varied a little from the one shown as the steam first struck an oblique plate forming one side of it, and had to ascend vertically before entering the condensing apparatus, thus rendering it impossible for anything but *pure steam* to obtain access thereto,) while the clean steam passed on becoming condensed in the main condenser, filled the reservoir below it up to the cock before mentioned. The water level in the boiler being noted, state of the fire, weight of coal to be supplied from, steam pressure and temperature of steam and water in boiler, temperature of feed water, and other observations amounting in all to about seventeen were taken every fifteen minutes.

We commenced to draw off the water of condensation from the "reservoirs" into a measure holding 8 lbs. of water, and poured its contents, when full, into a funnel fitted for the purpose of conveying the water to the feed pump, a mark being made for each 8 lbs. poured in under the *strictest* supervision.

Whenever the water-line in the boiler got lower than the level fixed upon, cold water was added to bring it up. Where this additional water went to was a matter of surprise, for not a particle of steam could be discovered leaking from the boiler, but as the supply required increased with the boiler pressure, it may be that the principal escape was there. There are, however, several connexions where a slight escape of steam was visible under a pressure of 210 lbs., at which sometimes the boiler blew off in consequence of stoppages; boiler water will waste very rapidly, although scarcely perceptible to the eye or ear. There was a little water overflow at the feed pump, but of no collectable amount. Blowing through the cylinder twice every fifteen minutes in taking indicator cards, would, I am sure, waste more than all the water which escaped from this source. The presumed greatest source of water escape on the first day was the suction pipe of the feed pump, which was under a pressure of only 3 to 4 feet of water; that was remedied, but the deficiency of water was increased on the next day, showing that the leakage was somewhere else, for it increased with the increase of pressure. The boiler stands upon four legs, is clear all around it, and admits of thorough examination. These are the reasons why I claim that all the water which entered the boiler was evaporated in effect by the action of the fuel consumed.

Prosser's Patent Boiler and Condenser.

Synopsis of the performance of the boiler and condenser, while under charge of a Board of United States Engineers appointed by the Hon. Isaac Toucey, Secretary of the Navy, and consisting of B. F. Isherwood, Esq., senior member of the Board, and late Chief Engineer of the war steamer "*San Jacinto*," J. W. King, Esq., Chief Engineer of the Brooklyn Navy Yard, and Wm. E. Everett, Esq., late Chief Engineer of the war steamer "*Niagara.*"

These trials of the boiler and condenser were continued during six days, occupying eight consecutive hours of each day, but this synopsis embraces only the two last of those days, and will doubtless be found to agree with the Report of the Board when forthcoming, so far at least as they may be comparable with each other.

Synopsis.

Averages of observations taken every fifteen minutes.

Notes.			Steam Full pressure	Steam Expand 2 7-9th times.
	The Manometers used were made by the Novelty Works. Temperature of the atmosphere from 70° to 80° Fah.	1859	April 29.	May 3.
	Coal consumed per hour on each foot of grate surface in	lbs.	16	16
	Load on safety valve of boiler per square inch,	"	150	210
	Total pressure of steam in boiler "	"	145	157
a.	Superheat of the steam in the boiler above the water,	F.	17°	49°
	Lowest total pressure in the steam chest per square inch,	lbs.	51	118·7
	Highest " of the exhaust steam "	"	16	16·4
	Initial pressure of unbalanced steam in the cylinder,	"	35	102·3
b.	Weight of water collected from *steam* condensed after passing into the condensing apparatus per pound of coal consumed,	"	10·019	9·8928
c.	Weight of water collected from *steam* condensed before entering condensing apparatus (in dirt trap),	"	·012	none.
d.	Weight of water added to keep up the water level in boiler "	"	·750	·9642
e.	Weight of water evaporated per pound of coal consumed,	"	10·781	10·857
f.	Temperature of exhaust steam in heater cistern,	F.	212·36°	213·64°
f.	" of feed water previous to entering the heater,	"	122·0	148·0
f.	" increased by passing through the heater,	"	62·3	38·8
f.	" of the feed water entering the boiler,	"	184·3	186·8
	Calculation for evaporation. Centigrade Thermometers made expressly for the purpose by Tagliabue.			
	Weight of water forced into the boiler by the feed pump (first hour of last day lost),	lbs.	2760	2432
	Weight of coal consumed in the evaporation thereof in eight and seven hours respectively,	"	256	224
	Weight of water evaporated from 84·6° C. to 175° by one pound of coal as above,	"	10·781	
	Weight of water evaporated from 85·96 C. to 183·5° by one pound of coal as above,	"		10·857
	Total heat in atmospheric steam above 100° C.=	C.	537·0	537·0
	" of feed water less than 100° C. (—84 6),	"	15·4	
	" " " (—85·96),	"		14·04
	Superheat of *steam* above the water reduced to its equivalent in proportion to its specific heat,	"	8·	23·
	Total heat in steam at 175° C. above that at 110° C.,	"	19·85	
	" " 183·5° C. " "	"		22·46
	" absorbed from the combustion of the fuel,	"	580·25	596·5
	Divided by 537° gives coefficient of the real evaporative effect,		1·0805	1·1108
	Which multiplied by the observed evaporation as above,		10·781	10·857
	Gives an evaporative effect from 100° C. per pound of coal of	lbs.	11·65	12·06

Notes on the foregoing Synopsis.

a. Superheating the steam and its effects.

These quotations are the best approximations attainable. The thermometers could not be put exactly into either the water or the steam of the boiler, and an allowance is therefore made to bring the temperature up to correspond with the pressure.

If this steam was not pure, where are we to obtain it? Surely not from the *test* boilers, either American or English, which I have described, unless indeed we are prepared to back the *gross* insinuation, that the tables used to show the relative volumes of steam and water may possibly be wrong to the extent of even "*one-half*."*

The increased amount of superheat in the steam on the last day, may be accounted for by the fact, that the smoke tubes and passages were thoroughly swept out the day before, whereas, on the first day's trial they had not been swept for two weeks.

Superheating the steam is one of the main objects of the boiler arrangement, at the same time it is believed to be the lightest, strongest, and most effective steam (real steam) generator ever produced. This is the boiler referred to in this *Journal*,† and with which I challenged any boiler in the United States to compete. It has now been more than two years in constant use; it is not in the least impaired, and is fully adequate to the bursting of any other boiler in existence that I know of.

Nearly all tubular boilers are known to prime badly. That is their greatest fault, and yet, we find the evaporative effect of boilers tested in such a manner as to induce the belief that priming was a desirable qualification, and those boilers which primed the most are usually extolled as evaporating the most.

The water being measured from a tank and pumped into the boiler, the sooner it was got out again through the cylinder, the better for the character of the boiler.

The remedy for priming is undoubtedly superheating the steam. There is no priming when that is properly effected.

b. It is not so much the water that goes into the boiler which is of any importance, but *the steam which can be caught uncondensed after it has left the cylinder* that we want to know about, for that is the steam, and that only, which has done the work. Of course, it is not possible with a jet condenser to ascertain this, and the only alternative is to measure it by the indicator.

The system which I here recommend is entirely trustworthy, for, between the cylinder and the condenser, with the means of separating the steam from the water, from whatever source the latter may be derived, there can be no possible source of error unless it be against the boiler, because, even if the condenser is leaky, the pressure on the inside of it being greater than on the outside, the condensed steam will be blown out rather than the condensing water drawn in.

To this test for evaporation my boiler has been subjected, and it is not too much to say, that there are many boilers of fair repute which will not furnish steam of equal efficacy with double the amount of fuel.

This water is from pure steam beyond all cavil. It is the first time to my knowledge, that the test of collecting the steam alone and condensing it, has ever been applied to the verification of the tank system of measuring the water before entering the boiler. I think it much more accurate than the indicator method.

The experiments were undertaken to test the boiler and condenser, and not the steam engine; the latter was merely made use of as a medium to pass the steam from the boiler, but was not indispensable or even necessary, except as furnishing the power necessary to pump back the water of condensation into the boiler.

To submit to the arbitration of the indicator, is to add all its faults and deficiencies to those of the engine, boiler, and condenser, whatever they may be, which the boys would call "going it blind."

It may be as fair for one as another of the same breed of boiler and condenser, but who puts his full-blooded courser to pull against a cart horse? My boiler produces undeniably pure and superheated steam; use it and let me have it back to condense and return to the boiler again as pure as the mountain dew. But what have I to do with the want of skill in the user of it, or with any fanciful mode which may be adopted of testing its power?

Even if the steam engine and the indicator were both perfect, there can be no benefit derived from their use, as mere measures of the weight of steam passed, for we obtain the absolute *steam* condensed into water to weigh and to measure as we please; all the loss is against the boiler, there can be no other error. No other system admits of this

* Indicator and Dynamometer by Main & Brown, page 32.

† Vol. xxxiv, (3d Series,) pages 201 and 202.

absolute certainty, nor, indeed, of any approach towards it, and hence the imperfect instruments which are indispensable to the testing of their power, only insures error in this case where truth is much more easily obtained by other means.

For, where a pound of steam has any fixed value, and we are sure that we get it, we are in possession of a *fixed standard*, with which no other can compare for accuracy.

c. This shows, that the superheat of 17° F. to steam of 145 lbs. total pressure, is nearly sufficient to prevent the appearance of water in the "*dirt trap*," and therefore for all practical purposes we may consider that 10 lbs. of steam may be calculated upon from 1 lb. of coal, of a quality usable, with as much certainty as a permanently elastic fluid, for it is quite obvious that there need be no condensation in the cylinder.

Now let it be insisted upon, that the question of the pressure of the steam is comparatively an important one; it is the weight that we want to be sure about, and having got that, a considerable difference of opinion about the pressure will not materially affect results; only allow that it is steam of the quality represented, and then, whether its elasticity is represented by 95 or 100 lbs. to the square inch, will make comparatively but little difference in the result of a calculation of its power, for within any reasonable limits the product of the pressure multiplied by the volume will show little variation, for what is gained in pressure will be nearly lost in volume.

d. The difference in these quantities is doubtless owing to the increased tension of the steam causing more steam leakage somewhere, and if within the boiler, then to the improvement of the draft, and much cheaper than by the blast-pipe. But the leakage is a mystery nevertheless, for if a boiler like this one leaks almost imperceptibly from 7·8 to 8·6 per cent., what must ordinary boilers leak? There is a well-grounded suspicion that *steam boilers leak far more than is generally imagined*, even when not a drop of water is visible. This alone seems to account for the large quantity of recuperative supply, which every boiler connected with a surface condenser is reported to require, and may also relieve the boiler of the "*Bee*" of a portion of the obloquy attached to it.

e. Even this amount exceeds any well authenticated *real* evaporative effect ever produced by any boiler, in ordinary working and without priming, and yet we have to add several items to it, before it is fairly placed for comparison with the two boilers before mentioned, to wit: the deficient temperature of the feed water, the increase of heat (superheat) in the steam beyond its normal amount, and also the additional total heat in the high pressure steam which was produced. These two last items effectually prevent condensation in the cylinder, and therefore supersede the necessity of superheating the steam by a separate apparatus, or of surrounding the cylinder with a steam jacket, for it accomplishes their work in a far more economical manner, with entire safety, efficiency, and convenience.

f. It has already been explained, that these temperatures were kept down, for the purpose of conveniently withdrawing the water of condensation. This occasioned considerable reduction in the temperature of the feed water, which in the ordinary way of working is actually 200° F., and although it may be increased, the conviction now is, that a higher temperature is not desirable at present, for when working thus, the exhaust steam has sufficient tension to go over into the still and produce distilled water of twice the weight of fuel consumed, which is deemed sufficient for any emergency.

(To be Continued.)

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*Lubricating Railway Brakes.**

According to an invention patented for a correspondent by Mr. Johnson, it is proposed to use, in connexion with any suitable lubricating apparatus, a capillary pad or cushion composed of wool, cotton, or other suitable material, and combined with a metallic conducting spout, which is pressed against the underside of the enlargement or shoulder of the journal of the axle or shaft. This pad sucks up the excess of oil which always collects at that point, and causes it to return either to the elevator or reservoir, so that there will be no waste of oil beyond a few drops occasionally. The pad should always be placed above the level of the oil, so that it will remain in a comparatively dry state.

*From the London Mining Journal No. 1236.

For the Journal of the Franklin Institute.

Experiments made by order of the Navy Department to Determine the Relative Advantages and Disadvantages of the Horizontal Fire Tube, and of the Martin Vertical Water Tube Boiler on board the U. S. Steam Frigate "San Jacinto."

When the U. S. Steam Frigate "*San Jacinto*" returned to New York from her late three years' cruise in the East Indies and the China Sea, a survey was held on her old flue boilers, and their condition was found to be such that it was deemed judicious to replace them with new tubular ones. A convenient opportunity was thus furnished to make a test of the comparative evaporative efficiency of the two competitive kinds of tubular boiler, and the vessel was accordingly fitted by the Navy Department with one horizontal fire tube boiler and one vertical water tube boiler; they have recently been experimented with by a Board of Chief Engineers, whose report is given below. It will be interesting to preface that report with a short description of the old boilers in order that the results of the change may be correctly appreciated.

The old boilers were three in number and of copper. They were of the double return drop flue type, and were placed in the vessel side by side with one chimney in common at the end opposite the furnaces. The fire room was $8\frac{1}{2}$ feet wide and extended athwartship.

Length of each boiler, . .	25 feet 6 inches.
Breadth " . . .	9 " 9 "
Height " (exclusive of steam chimney,)	10 " 6 "
Number of furnaces in each boiler,	2.
Width of each furnace, . .	4 " $2\frac{1}{2}$ "
Length of fire grates, . .	7 " 9 "
Total grate surface in the three boilers,	197·8 square feet.
" heating " " .	5250· "
Aggregate cross area of the upper row of flues in 3 boilers,	35·133 "
" " middle " "	33·008 "
" " lower " "	32·146 "
Cross area of the chimney, . .	34·039 "
Height of the chimney above the grate bars,	55 feet.
Capacity of steam room in the three boilers,	2440 cu. ft.
Weight of the three boilers without chimney and grate bars,	213,256 lbs.
Weight of water in the three boilers at 12 inches above flues, and at 250° Fahr., .	121,200 "

With these boilers during the last three years' cruize of the vessel in the East Indies and China Sea, there was obtained the following mean results, namely:—

Number of pounds of Pennsylvania anthracite consumed per hour,	2115·00
" " " " per sq. ft. of grate,	10 69
Waste in ashes, clinker, and fine coal, . .	25 per centum.
Pounds of water evaporated per pound of anthracite from tem. of 100° F.,	6 00
" " " combustible " "	8·00

The economic evaporation by the new horizontal fire tube boiler, according to the experiments referred to, exceeds the above by $11\frac{1}{5}$ per centum, making the comparison by weight of combustible; and by $11\frac{1}{2}$ per centum if it be made by weight of coal: while the evaporation by the vertical water tube boiler exceeds it by $31\frac{3}{4}$ per centum per

unit of weight of combustible; and by $29\frac{1}{3}$ per centum per unit of weight of coal.

By the change of boilers the ship carries in the same space as originally allotted to the machinery and fuel, 40 tons more coal, increasing the quantity from 320 to 360 tons.

The aggregate weight of the original boilers and water was $149\frac{3}{10}$ tons; with the present boilers this weight is $115\frac{7}{10}$ tons.

It will be perceived that while with the present boilers, the aggregate weight of boilers, water, and fuel exceeds the aggregate weight of the original boilers, water, and fuel by only $6\frac{2}{3}$ tons, the time that the vessel can steam at the rate of 175 geographical miles per twenty-four hours, has been increased from 14 to 18 days.

The original boilers were about eight years old, and the middle and lower return flues and their connexions, comprising about two-thirds of the total heating surface, were covered during the whole cruize with old scale varying from $\frac{1}{16}$ to $\frac{1}{8}$ inch thick. This surface was inaccessible for scaling, and from the condition of the seams it would have been injudicious to have attempted it. No new scale was formed during the cruize, as the surface condenser operated satisfactorily.

Navy Yard, New York, June 24, 1859.

Hon. Isaac Toucey, *Secretary of the Navy.*

Sir:—In obedience to your order of May 17th, 1859, the undersigned have experimented with the vertical water tube and the horizontal fire tube boilers on board the U. S. Steamer "*San Jacinto,*" in the manner and for the purpose therein directed: and have the honor to submit the details of the experiments and their results in the following REPORT.

Before giving an account of the manner of conducting the experiments, and the data obtained—it will be satisfactory to preface it with the following brief description of the boilers and engines employed.

Boilers.—The two boilers had precisely the same shell, both as regards form and dimensions. Also, the furnaces, ash-pits, doors, and smoke connexions were precisely alike, and the grate bars were cast from the same pattern. The minimum calorimeter or area for draft through the tubes was likewise the same in both boilers; the fire grate surface employed was of the same area; and both boilers delivered in common into one smoke pipe, placed at the centre of their length, and immediately over the fire room. The boilers were situated in the vessel face to face, with a fire room $8\frac{1}{2}$ feet wide between them, and extending in the direction of the vessel's length.

As regards dimensions, the only difference between the boilers was in the heating surface, which was considerably the greatest with the vertical water tube boiler.

As regards design, the only difference between the boilers was in the arrangement of the tubes, which in one, was according to the type known as the English tubular or the horizontal fire tube boiler; while in the other, it was according to the patent of Chief Engineer, Daniel B. Martin, U. S. N., and is of the vertical water tube type.

In both boilers the relative positions of tubes and furnaces are the same, the tubes being placed immediately over the furnaces; and in both boilers the tubes occupy sensibly the same space, namely: a length of 7 feet, a breadth of 3 feet, and a height with the horizontal fire tubes of 37 inches, and with the vertical water tubes of 33 inches; but this difference of 4 inches is compensated by the greater distance between the tubes and furnace crown indispensably necessary with the latter.

The comparative dimensions and weights of the boilers will be found in the following Table:

Dimensions and Weights of Boilers.

	English horizontal fire tube boiler.	Martin's vertical water tube boiler.
Width of boiler (fore and aft direction of the vessel,) in feet and inches, ...	21 3	21 3
Length of boiler (athwartships) at furnaces in ft. and ins.,	10 6	10 6
" " " extreme " "	11 6	11 6
Height of boiler exclusive of steam chimney in ft. and ins.,	11 3	11 3
" inclusive " " "	13 3	13 3
Number of furnaces, ...	6	6
Width of fire grate in each furnace in feet, . .	3	3
Length " " . . .	6	6
Aggregate area of fire grate surface in square feet, .	108	108
Heating surface in the six furnaces, in square feet,	289·20	289·20
" " back smoke connexion, "	159·36	119·36
" " front " "	136·40	106·40
" " tubes measured on their exterior circumference in square feet,	2282·67	2332·64
" " tubes measured on their interior circumference in square feet,	2078·92	2111·00
" " sides, tops, and bottoms of the tube boxes in square feet, .		447·65
Total heating surface, the tube surface being measured on the exterior circumference in square feet, .	2867·63	3295·25
Total heating surface, the tube surface being measured on the interior circumference in square feet, .	2663·88	3073·61
Number of brass tubes, ...	414	1620
External diameter of the tubes in inches, .	3	2
Internal " "	2·732	1·810
Length, in inches of the tubes, extreme, . .	84½	33
Thickness of metal of the tubes in inches, . .	0·134	0·095
Weight of the tubes in pounds, ...	10115	9856
Calorimeter or area for direct draft through the tubes in square feet, ...	16·854 16·854	16·889 front 21·555 back.
Diameter of smoke pipe in feet and inches, .	6 4	6 4
Height " " " above fire grate,	51 6	51 6
Steam room measured from nine inches above top of tubes in cubic feet, ...	735	776
Weight of water in boiler at 250° Fahr., measured from 9 inches above top of tubes in pounds, . .	46600	39200
Weight of boiler exclusive of water, grate bars, and valves, but inclusive of tubes in pounds, . .	86412	86860
Length occupied by the tubes in each boiler in inches,	84½	84½
Height " " "	37	33
Space between crown of furnace and bottom of tubes in inches, ...	7	9

Engines.—The engines are geared, and the cylinder valves are of the usual double poppet kind. The steam is cut off by the steam valve with the adjustable arrangement patented by Allen & Wells. The two cylinders are connected upon the driving shaft at right angles to each other; and they have in common one surface condenser constructed according to the patent of J. P. Pirsson.

The following are the dimensions required to be known in connexion with the experiments, namely:—

Diameter of the forward cylinder, . .	$70\frac{1}{8}$ inches.
" after " . .	$70\frac{3}{8}$ "
Stroke of piston of both engines, . .	4 feet.
Aggregate area of both pistons, . .	7752 sq. ins.
Space displacement of the pistons of both engines per stroke,	215·33 cu. feet.
Space comprised between pistons and cut off valves at one end of both cylinders, . .	9·61 "
Total space filled with steam of the final cylinder pressure, per stroke of both pistons, . .	225·94 "

Mode of Conducting Experiments.—The experiments were made to determine the *relative* evaporative efficiencies of the two boilers under the conditions of actual practice on board marine steamers. For this purpose a short experiment would be valueless from the impossibility of knowing whether the condition of the fires was exactly the same at the commencement and at the end—from the inequality in firing—from the different proportions of refuse found even in different shovelfulls from the same heap of coals—from fluctuations in the draft—from the losses by cleaning the furnaces—and from the different quantities of air in proportion to fuel admitted at different times. It was, therefore, considered necessary that the experiments with each boiler should continue uninterruptedly four days or ninety-six hours. The weight of water evaporated was to be ascertained from the steam pressure in the cylinder at the end of the stroke of piston as given by the indicator. The cost of this evaporation was the weight of combustible consumed; by combustible is meant the remainder of the coal after deducting the refuse withdrawn from the furnaces as ashes, clinker, and fine coal.

The evaporation as thus determined, though relatively correct, is not absolutely so; because it is exclusive of the steam condensed in the boiler, in the steam pipes, in the cylinders, &c., and of the loss of heat by priming and leakage; but on the other hand, the evaporation measured by water in a tank previous to its entering the boiler would also be incorrect from the loss by priming and from leakage. The tank measurement gives too great an evaporation, the indicator measurement too small a one; but the latter is the most useful practically, because the most convenient and habitually employed; in effect, it is only comparative results that could be obtained in either case, and they are all that are practically needed.

The experiments were conducted in precisely the same manner with both boilers, and as follows, namely: At the commencement no account was taken of the coal required to raise steam, or of the temperature of the water in the boilers; but after steam was raised to 22 lbs.

per square inch pressure above the atmosphere, the level of the water in the boilers was noted, the condition of the fires estimated as nearly as possible by the eye, and the engines started. At the end of each experiment, the water in the boiler and the condition of the fires were left as at the commencement. The experiments with both boilers were begun and ended at mid-day, and continued uninterruptedly ninety-six hours. During that time, the boiler steam pressure and the vacuum in the condenser by barometer gauges were noted every fifteen minutes, and at the close of each hour there was recorded for that hour the mean steam pressure, vacuum, temperature of engine and fire-rooms, of the salt and fresh water hot-wells, and of the injection water; also the weight of coal thrown into the furnaces, and the weight of dry refuse in ashes, clinkers, and fine coal withdrawn. Each hour an indicator double diagram was taken from both cylinders, and from the mean of the final pressures as given by these diagrams the evaporation was calculated. Owing to excessive condensation in the cylinders and the continual discharge by their relief valves of the resulting fresh water, the surface condenser gave a deficit of one-sixth, that is to say, it returned to the boiler as distilled water, five-sixths of the steam leaving it. At the commencement of each experiment the boiler was filled with sea water, and at the expiration of every hour the saturation was recorded, and also the number of inches in depth of water blown off to maintain it at $1\frac{1}{2}$ times the natural concentration. Every pound of the coal and refuse was carefully weighed by a steelyard. The number of double strokes made by the piston was taken by a self-registering counter. The indicators were excellent instruments, and every precaution was taken to insure exact similarity of circumstance with both boilers. The cut-offs set to cut off the steam in the cylinders at $\frac{48}{100}$ of the stroke of piston from the commencement, were secured to prevent accidental alteration. The throttle (a butterfly valve) was kept unchanged at two holes open, eight holes being wide open. The same fireman fired both boilers and the same assistant engineers directed them.

The experiments were first made on the horizontal fire tube boiler; they were begun at noon on the 10th of June, and after being completed, the steam was shut off from it and let on from the vertical water tube boiler without stopping the engines. The piston and cylinder valves of both engines on being tried at the termination of the experiments, noon June 18th, exhibited no sensible amount of leakage.

The coal used was hard Pennsylvania anthracite of very indifferent quality, giving for a mean with slow combustion and careful firing, the excessive amount of over 25 per centum of dry refuse.

In the following Table will be found the complete data and results of the experiments:

Data and Results of the Experiments.

DATA.	English horizontal fire tube boiler.	Martin's vertical water tube boiler.
Duration of the experiments in consecutive hours,	96	96
Total number of double strokes of pistons made by the engines per counter,	62518	64196
Mean number of double strokes of pistons made per minute by engines,	10·854	11·145
Mean pressure of steam in boiler in pounds per square inch above atmosphere,	10·43	11·41
Mean vacuum in condenser in inches of mercury, per barometer gauge,	21·48	20·80
Total number of pounds of anthracite consumed,	100436·00	92512·00
" " refuse in ashes, clinkers, and fine coal,	24908·00	24178·00
" " combustible consumed,	75528·00	68334·00
Per centum of the anthracite in refuse,	24·80	26·14
Mean pressure above zero, per indicator, in pounds per sq. inch, of the steam in cylinders at commencement of stroke,	19·44	10·40
Mean pressure above zero, per indicator, in pounds per sq. inch, of the steam in cylinders at point of cutting off,	16·40	17·20
Mean pressure above zero, per indicator, in pounds per sq. inch, of the steam at end of stroke of piston,	9·11	9·50
Mean gross effective pressure on pistons in pounds per sq. inch, per indicator,	9·18	9·63
Mean back pressure above zero against pistons in pounds per square inch, per indicator,	5·50	5·75
Mean gross horse power developed by the engines,	187·25	201·696
Mean number of pounds of anthracite consumed per hour,	1046·21	963·67
" " " " per square foot of grate,	9·687	8·923
Mean temperature in degrees Fah. of the engine room,	96	106
" " " on deck,	61	74
" " " of the fire room,	99	112
" " " salt water hot-well,	100	102
" " " fresh "	100	100
" " " injection water,	62	65
Total number of pounds of water blown out of boiler to keep the saturation at $\frac{1\frac{1}{2}}{32}$.	68424	123144
RESULTS.		
Number of pounds of water evaporated from feed water temperature of 100° Fah., calculated from the steam pressure in cylinder at end of stroke,	663629·007	705468·426
Number of pounds of water evaporated from feed water temperature of 100° Fah., due to the weight of boiler water blown off,	8183·448	14857·488
Total number of pounds of water evaporated from feed water temperature of 100° Fah.,	671813·455	720325·914
Pounds of water evaporated from feed water temperature of 100° Fah. by one pound of anthracite,	6·689	7·786
Pounds of water evaporated from feed water temperature of 100° Fah. by one pound of combustible,	8·895	10·541

Comparative advantages and disadvantages.—We are directed by your order to report to the Department the relative advantages and

disadvantages of the two kinds of boiler as regards space occupied, weight, cost, accessibility for cleaning and repairs, durability, evaporative efficiency, and the relative quantities of steam that can be furnished in equal times.

1st, *As regards space.*—In the particular specimens experimented on, the space occupied by both types of boiler was equal; but not so the area of contained heating surface. If the proper measure of that surface be, as we think it is, the extent exposed to the reception of heat from the products of combustion, then the heating surface in the vertical water tube boiler exceeded that in the horizontal fire tube boiler by nearly $23\frac{3}{4}$ per centum of the latter. If, however, it be measured by the extent from which water is evaporated, then the superiority will still remain with the vertical water tube boiler but reduced to $7\frac{1}{5}$ per centum.

2d, *As regards the weights of the two boilers.*—By referring to the table of their dimensions and weights, it will be seen that in this respect the experimental boilers were nearly equal, the horizontal fire tube having a slight advantage in lightness; but if the aggregate weight of boiler and contained water at a steaming level be compared, then the vertical water tube has a superiority of nearly $5\frac{1}{4}$ per centum over its competitor.

3d, *Cost.*—In this particular the horizontal fire tube boiler is slightly the cheapest, but the difference is unimportant.

4th, *Accessibility for cleaning and repairs.*—For the removal of scale or any insoluble sediment on the water surfaces of the tubes, the vertical water tube boiler has a decisive superiority, from the complete and easy manner in which the entire of those surfaces can be reached by a scaling tool and cleaned mechanically. With the horizontal fire tube boiler, this operation is very tedious and difficult, and at the best is only partial. It may, indeed, be said, that the whole of the horizontal tubes cannot be scaled without the removal of a portion of them: and from the fact of their becoming more and more coated with scale as their age increases, their evaporative efficiency will be continuously impaired to the extent of the loss of heat thus intercepted. On the other hand, the horizontal fire tubes are much more easily and completely swept of soot and deposit from the furnaces; they are also more easily plugged when leaking. Furthermore, they are only about one-fourth the number of the vertical water tubes, and the liability to leakage is correspondingly lessened, but this liablity is so trifling as to be of no value in a practical estimate. The remaining portions of both boilers are equally accessible for cleaning and repairs.

5th, *Durability.*—We have no data on which to base an opinion in this respect, but we believe both boilers to be about equal.

6th, *Evaporative efficiency.*—The relative evaporative efficiency as given by the experiments, applies rigorously only to the particular specimens of the types of boiler employed, with their peculiarities of proportion, and under the conditions of the trials. Under other conditions, and with other proportions, the relative evaporative efficiency would doubtless be different, and in direction as determined by better or worse

proportions, and by conditions more or less favorable for one kind of boiler over the other. The proportions given to both boilers in the present case, however, are such as are now generally approved in practice.

With these proportions, and under the actual conditions of the trials, the evaporative efficiency of the vertical water tube boiler exceeds that of the horizontal fire tube by $18\frac{1}{2}$ per centum of the evaporation of the latter, making the comparison by weight of combustible consumed; and by $16\frac{2}{3}$ per centum if the comparison be made by weight of coal consumed; the former is, of course, the proper result.

7th, *Relative quantities of steam that can be furnished in equal times by the two boilers.*—In this respect the superiority remains with the horizontal fire tube boiler in which the combustion of the fuel can be forced to a considerably greater extent than in the vertical water tube boiler. The additional steam, however, thus obtained, will be at a greater *pro rata* cost of coal; but we have no data to determine either the increased quantity or its increased cost.

Finally, in view of the much greater evaporative efficiency of the vertical water tube boiler, and of the facility and completeness with which it may be scaled—the two qualities of paramount importance with marine boilers—we would express our decided opinion that its superiority over the horizontal fire tube boiler is so strongly marked as to unquestionably entitle it to the preference.

We have the honor to be, sir, with great respect,

Your obedient servants,

B. F. Isherwood, Wm. E. Everett,
James W. King, John Faron,
Chief Engineers, U. S. N.

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*On the Relative Values of Coke and Coal in Locomotive Engines.**

By Benjamin Fothergill.

Having attended a meeting in the Society's rooms, on 2d December, 1857, and taken part in the discussion relating to the use of coke and coal in the furnaces of steam engine boilers, I then undertook to lay before its members the results of a series of experiments which I had made with coke and coal in locomotive engines in corroboration of the truth of my assertions:

First, That coal was decidedly superior to coke in respect to heating power, and consequently more economical.

Second, That a plentiful supply of steam could be generated by the use of coal for working engines at high velocities and for drawing heavy trains.

Third, The capabilities of coal-burning engines for consuming their own smoke: and,

* From the Jour. of the Society of Arts, No 339.

Fourth, The increased durability of fire-boxes and tubes when coal was used.

On that occasion I stated, that my experiments had been conducted upon the London and South Western Railway, and were made, at the request of the directors, to ascertain the value of an invention which had been patented by their Locomotive Superintendent, Mr. Joseph Beattie. This contrivance will be readily understood by referring to the drawings on the walls, where the fire-box is shown in section, divided transversely into two compartments by an inclined water space mid-feather or diaphragm, and a dependent water space hanging from the roof. Both compartments are arched over with fire tiles at narrow intervals apart. The boiler is constructed with a combustion chamber, extending to about one-half its length, and it has a vertical mid-feather or diaphragm in the centre running parallel with its sides. The other half is supplied with tubes in the ordinary manner. The object of this contrivance is to increase the amount of direct heating surface and to diminish the indirect or tube surface, whilst the combustion chamber affords sufficient space for the introduction of a series of fire tiles, for the purpose of retaining a portion of the heat given off from the combustion of the gases in the fire-box, and for diffusing the unconsumed carbon as well as effecting a complete mixture of the air with the gases, and thereby producing a mass of flame which is brought in contact with the direct heating surface of the combustion chamber before it enters the tubes, at the same time preventing practically such an escape of smoke from the chimney as could be deemed a nuisance.

The back or first furnace is the most actively worked, the second being intended to carry incandescent fuel. The ash pans are furnished with dampers for the admission of air when necessary; and this is also admitted through the small apertures in the fire doors and through hollow stays in the fire-box.

In addition to the mechanical contrivances referred to, Mr. Beattie has another of considerable importance for using a portion of the exhaust steam for heating the feed water before it enters the boiler, and as I have tried both his contrivances for this desirable object, I need only refer to the one represented on the drawing, which shows the pipes for conveying the water and steam to the tank under the footplate of the engine, from which the feed-pumps receive their supply. The water is received on to a perforated plate in this tank, and in its descent comes in contact with and condenses the steam, and thereby becomes heated; the supply of water is regulated by the ball-tap or valve, and the steam is admitted or shut off whenever the engine driver has occasion to supply or shut off the feed-water to the boiler.

In the course of my first series of experiments, I have used the feed-water supplied by Mr. Beattie's apparatus, at a temperature of 196°.

I may here observe that I was anxious to obtain an analysis of the fuel used by the London and South Western Railway Company, and the more so as I found they manufactured their own coke from "Ramsay's Coking Coal" (Newcastle), which is of a superior quality; and

as it was desirable to ascertain, as far as possible, whether the coke or the coals which were supplied to me contained the greatest amount of sulphur, I sent samples of each to Mr. Dugald Campbell, Analytical Chemist to the Brompton Hospital, and he, after a careful examination, furnished me with the following statement, viz:—

"The samples I received were four in number, and marked as follows:—

No. 1.—Ramsay's coking coal.
No. 2.—Coke.
No. 3.—Llanguathog Merthyr, shipped Swansea, Neath, and Cardiff.
No. 4.—Griff coal.

"No. 1.—Ramsay's Coking Coal—Is of a jet sparkling appearance, and is broken up without much difficulty by the fingers into rather thick layers, between most of which are thin plates of iron pyrites, which, I may state, is a compound of iron and sulphur, in the proportion of one of the former to two of the latter. When the coal is reduced to a very fine powder—in which state it is required for analysis—its jet black appearance gives place to a considerable brown tint, which indicates it to be of a bituminous character.

"This coal is rather above the usual density of Newcastle coal, being 1279, water taken as 1000.

"The analysis in 100 parts is as follows:—

Carbon,	85·57
Hydrogen,	5·68
Oxygen,	3·07
Nitrogen,	1·48
Sulphur,	1·46
Moisture,	0·74
Ash,	2·00
	100·00

"The calorific value of a substance is generally estimated in two ways; firstly, by calculating from its ultimate analysis what quantity of water a known weight of the fuel would evaporate from 212° Fah.; and, secondly, by ascertaining how much oxide of lead is capable of being reduced to the metallic state by a known quantity of the fuel.

"These experiments when conducted upon the different specimens of fuel under precisely similar circumstances, which has been the case in this instance, give results extremely useful for comparing the economic value of the fuel. By such means, 1 lb. of No. 1 Ramsay's coking coal was found to be capable of evaporating 15·18 lbs. of water from a temperature of 212° Fah., and 1 lb. of reducing 34·99 lbs. of metallic lead from the oxide.

"No. 2.—Coke made from Ramsay's Coking Coal.—The specimen I received of this substance was a thin column, which, from its appearance, must have occupied a space from the top to the bottom of the coke in the coking furnace. An average sample was selected from this for examination, and the results obtained were as follows:—

"Density of coke 1055, water being 1000. The analysis in 100 parts,

Carbon,	86·91
Hydrogen,	1·32
Oxygen,	0·10
Nitrogen,	0·80
Sulphur,	1·94
Moisture,	1·28
Ash,	7·65
	100·00

"One pound of this coke is capable of evaporating from 212° Fah. 12·78 lbs. of water; and 1 lb., of reducing from the oxide of lead 31·35 lbs. of metallic lead.

"No. 3.—Llanguathog Merthyr.—This coal has a bright sparkling appearance, resembling to some extent (No. 1) Ramsay's coal; but it is rather more dense, and not so easily broken; when broken, however, the layers are not so thick, and between them no iron pyrites are visible, but thin plates of silicate of lime are occasionally noticed.

"Density of coal 1333; water 1000. The analysis in 100 parts,

Carbon, . . .	89·16
Hydrogen, . . .	4·06
Oxygen, . . .	1·65
Nitrogon, . . .	1·21
Sulphur, . . .	1·39
Moisture, . . .	0·67
Ash, . . .	1·86
	100·00

"One pound of this coal is capable of evaporating from 212° Fah., 14·74 lbs. of water, and 1 lb. of reducing from the oxide of lead 34·74 lbs. of metallic lead.

"No. 4.—'Griff' Coal.—This is a coal of a dull appearance, dense and hard, with a concoidal fracture, different from either of the other two coals.

"Density of coal 1341; water 1000. The analysis in 100 parts,

Carbon, . . .	66·21
Hydrogen, . . .	4·09
Oxygen, . . .	11·07
Nitrogen, . . .	1·13
Sulphur, . . .	1·01
Moisture, . . .	9·23
Ash, . . .	7·26
	100·00

"One pound of this coal is capable of evaporating from 212° Fah. 9·8 lbs. of water, and 1 lb. of reducing from the oxide of lead 25·14 lbs. of metallic lead.

"Table of Foregoing Results:—

	No. 1. Ramsay's Coking Coal.	No. 2. Coke from Ramsay's Coking Coal.	No. 3. Llanguathog Merthyr Coal.	No. 4. Griff Coal.
Density, .	1·279	1·055	1·333	1·341
Carbon, . .	85·57	86·91	89·16	66·21
Hydrogen, .	5·68	1·32	4·06	4·09
Oxygen, .	3·07	0·10	1·65	11·07
Nitrogen, .	1·48	0 80	1·21	1·13
Sulphur, .	1·46	1·94	1·39	1·01
Moisture, .	0·74	1·28	0·67	9·23
Ash, . .	2·00	7·65	1·86	7·26
	100·00	100·00	100·00	100·00
Pounds of water which 1 lb. of fuel would evaporate from 212° Fah.,	15·18	12·78	14·74	9·8
Pounds of lead reduced by 1 lb. of fuel.	34·99	31·35	34·74	25·14

"In glancing at the above table, the first thing that arrests the attention is the proportion of sulphur being greater in the coke than in the coal from which it was made, and by nearly half a per cent.

"It appears from my analysis that, although in coking coal there may be a notable loss, in the per centage of carbon, hydrogen, oxygen, and nitrogen, in the coke, yet the sulphur has not only not decreased, but has actually increased in the per centage. I find in the coking oven that not more than one-twelfth of the sulphur goes off from the coal, whilst the loss of the other gases is upwards of one-third of the whole.

"But portions of the coke may be found to contain a very much larger quantity of sulphur than I found in the above specimen, and if I had selected a piece from near the top of the column, instead of taking an average of the whole, I should have found very much more than I did.

"The pieces of coke delivered to me by your assistant, which he told me he had taken from the tender of an engine in going down to Southampton, on the 2d ultimo, gave, on an average, 5·62 per cent of sulphur, and some which I selected myself from the coke-heap at the Nine Elms station gave about 5 per cent.

"The next peculiarity to be noticed between the coke and the coal from which it is made is, in the amount of ash being very much higher in the former than in the latter; this is caused by an excess of iron and silica principally, and were it not for the increase of ash there would not be so very much difference in their heating power, &c. I can only account for this increase in these two substances from their being volatilized in the coking ovens, and entering into the crevices of the fuel from which the gases escape.

"It is common to find large quantities of a hair-like substance adhering to the coke, varying in color from a light grey to black; this is silica, with a trace of carbon and iron, and which has been in a state of volatilization till arrested by coming to a cooler part of the coking oven, where it has condensed, and is found as I have described it.

"No. 3.—Llanguatnog Merthyr Coal,—You will observe, is a coal of a very superior quality, and is nearly equal to Ramsay's coking coal in heating power, and has a very little less per centage of sulphur; but No. 4, 'Griff' coal, though containing less sulphur than either, does not possess such heating power, which is partly owing to its containing a large per centage of water; this water is expelled when the coal is reduced to a fine powder, and submitted for some time to a temperature of 212° Fah. The moisture in the other specimens was determined in a similar manner.

"I may state that my experiments were repeated, and great care was bestowed to verify any results which appeared contrary to what should have been expected, such as the larger amount of ash in coke, in comparison to the coal from which it was made, and the larger amount of sulphur in coke than in coal, the general belief being that in the coking of coal most of the sulphur is driven off."

I will now proceed to give a detailed statement as to my mode of procedure to ascertain the quantity of fuel consumed per trip from the Waterloo Station, London, to Southampton and back again, inclusive of the quantity used in getting up steam in the morning, and whilst waiting at Southampton. I personally inspected the weighing of the fuel in the morning, and again at Southampton, and on the return of the engine to Nine Elms I took an account of the coal which remained on the tender, and I had the fire-box cleared out, the hot material cooled and riddled, and the worthless portion separated, and I allowed the value in good coal for the remainder.

I commenced my experimental trips with the coal engine "Ironsides," which had been constructed on Mr. Beattie's patented plans, for burning coal only, and heating the feed-water, and took the 10·15 A.M. mail train from Waterloo to Southampton, and arrived there at 1·5 P.M. We commenced the return journey at 3·0 P.M., and arrived at the Waterloo Station at 5·58 P.M., the engine having performed the trip in the most satisfactory manner, and without any appearance of smoke, except when the steam had to be got up in the morning, or the fires prepared for the return journey.

The result of that day's trip will be seen by referring to the tabu-

lated summary opposite November 15th, where the average consumption of fuel is shown as 16·71 lbs. of coal per mile, or when reduced to its coke value, equal to 11·14 lbs. per mile, with an average load of 12·2 carriages per mile, traveling at an average speed of 31·25 miles per hour.

I have said that the consumption of coal, when reduced to its coke value, was equal to 11·14 lbs. per mile; in explanation of my meaning, I beg to state experience has proved that, in order to make one ton of good coke suitable for locomotive engines, $1\frac{1}{2}$ tons of the best coking coal is required, and with some kinds of coking coal, $1\frac{1}{2}$ to $1\frac{3}{4}$ tons are necessary to produce one ton of coke. It will be evident then, that if the same load can be taken, at the same velocity and under the same circumstances in respect to weather, with equal weights of fuel, say with coal in engines fitted up with Mr. Beattie's patented contrivance, and with coke in the ordinary class of engines, a net saving is effected of one-third, or 33 per cent., in fuel alone. without taking into consideration the incidental saving consequent on the construction of coke ovens, the interest on capital, the cost of their maintenance, and the wages of workmen employed in the manufacture of coke.

From the tabulated summary it will be seen, that I worked the coal engine "Ironsides" for three days with little variation in respect to the quantity of fuel consumed, that little variation arising from the change in the weather. I then selected the coke-burning engine "Vesuvius," one of the ordinary class, and being nearest in dimensions and weight to the "Ironsides," and in good working order, and with it I took a similar train (10·15) to and from Southampton, burning coke only, and I adopted the same course of proceeding as on the former trips, but with a very different result as regards the consumption of fuel; for, on referring to the general summary, it will be seen that the average load was 12·1 carriages, the average speed 30·27 miles per hour, while the average consumption of fuel was 20·62 lbs. of coke per mile. On the following day I took the "Express" train with the same engine, but the results were substantially the same as on the previous day with the "mail" train.

Having tried the "Vesuvius," I decided upon taking another coke-burning engine (the "Frome,") which was a similar class engine to the "Vesuvius," in order to ascertain if there was any difference in the results of their working. On referring to the summary of the trip opposite November 22d, it will be seen that the consumption of fuel was remarkably near that of the "Vesuvius."

I then determined to test the capabilities of another coal-burning engine, the "Canute," and compare the results of its working the "Express" train with that of the "Vesuvius." The load was lighter, averaging 9·3 carriages, but the average speed attained was higher, being 36·76 miles per hour. The consumption of fuel was 16·71 lbs. of coal per mile, the coke value of which is 11·14 lbs. per mile against 20·62 lbs. per mile consumed by the "Vesuvius."

The experiments up to this period showed a decided advantage in the coal-burning engines, so far as regarded economy of fuel, &c., but

the results were not conclusive to my mind, inasmuch as the engines had not worked under precisely the same circumstances with respect to weather and uniformity of load and speed. I therefore obtained a sufficient number of carriages to form two trains of equal size and weight, and I had a quantity of materials weighed and placed in each of them equivalent to a load of passengers. The coal-burning engine "Canute," was attached to one of the trains, and the coke-burning engine "Vesuvius," to the other. The weight of the train, including engine and tender, drawn by "Canute," was 170 tons, 8cwt., and that drawn by "Vesuvius," 167 tons, 12 cwt.

The trains left London and Southampton within a few minutes of each other, so that there could be no difference between them in respect to weather, but lest either train should run heavier than the other from extra friction in the axle bearings, I took a second trip on the following day with the engines changed from one train to the other. I registered the particulars of each day's trip separately, but taking the average of the two days working, the difference in respect to consumption of fuel will be more readily seen.

	Average speed.	Average consumption of fuel in lbs. per mile.	Load.
"Canute,"	28.40	Coal, 20·36	19 carriages.
"Vesuvius,"	27·23	Coke, 24·37	19 "

Coal reduced to its coke value 13·57, which shows a clear saving of 10·80 lbs. per mile.

I subsequently tested the capabilities of the coal-burning engine "Canute" for making sufficient steam when drawing heavy loads, and as this engine was rather heavier than the coke-burning engine "Vesuvius," I obtained an additional number of carriages, and after they had been weighted, I had twenty-eight of them attached to the "Canute," and twenty-two to the "Vesuvius," making the total weight of the "Canute" train 235 tons 13 cwt., and that of the "Vesuvius" train 189 tons 6 cwt. I was very desirous of testing the capabilities of the coal engine "Canute" for drawing a heavy load up the incline from Southampton to Andover (a distance of 22 miles) without the aid of a pilot engine, and for that purpose I added about 20 tons extra weight to its train beyond its proportionate load.

Early in the morning of December 19th, 1855, we proceeded to Southampton with the two trains, but unfortunately the water pipe attached to the lower part of the boiler in the "Canute" engine gave way, and the leakage therefrom became so great soon after we left Southampton, that we were obliged to pump into the boiler an extra supply of water to compensate for the loss sustained. A reference to the registered account of the trip on that day will show that while the "Vesuvius" (coke) engine evaporated 7·13 lbs. of water by 1 lb. of fuel, the "Canute" (coal) engine evaporated 9·05 lbs. of water by 1 lb. of fuel. The amount of water, therefore, which passed from the tender of the "Canute" engine was greater by 1·92 or nearly 2 lbs. of water per 1 lb. of fuel, than that from the tender of the "Vesuvius," but notwith-

standing that mishap, the "Canute" generated sufficient steam to draw the 28 loaded carriages up the incline without any aid whatever.

The firing, from the same cause, was increased, but the result on the day's work of the two engines was still in favor of the coal-burning engine, as will be seen from the summary, and it is worthy of remark that when the coal is reduced to its coke value, the result is 10·30 lbs. per mile in favor of the coal-burning engine, "Canute."

I have shown that the saving effected by the coal-burning engines with the ordinary trains, was equal on the average to 8·56 lbs. of coke per mile, or 10·80 lbs. of coke per mile when each engine worked under the same circumstances as to weather, &c., with equal loads; now, if the former quantity, viz., 8·56 lbs. per mile be taken, the saving is equal to 1·348 lbs. on each trip, or at the rate of 187¾ tons per engine per annum, at six days work in each week; but if the latter quantity, viz., 10·80 lbs. per mile be taken, the saving is equal to 1·721 lbs. at each trip, or 239½ tons per engine per annum.

The consumption of coke by the coke-burning engine "Vesuvius" during one of the trips referred to, was 29½ cwt., which, at 31s. 6d. per ton, was equal to £2 6s. 6d., whereas, the consumption of the coal-burning engine "Ironsides," during another of the trips, was 24¾ cwt., which, at 19 s. per ton, was equal to £1 3 s. 6 d., giving a clear saving on the latter per trip, of £1 3 s. In my report to the Directors of the London and South Western Railway Company, I stated that if they had seventy engines in steam per day, and each of them was fitted up for burning coal, and all worked under similar circumstances to the "Ironsides," there would be a daily saving to the Company of £80 10s., or £483 per week of six days, or £25,116 per annum.

From the result of these interesting and important experiments, I trust I have succeeded in demonstrating the truth of the assertions I made at the meeting to which I have referred, namely, that coal can be used more economically in locomotive engines than coke; that by the use of coal sufficient steam can be generated to supply locomotive engines when working at high velocities and when drawing heavy loads; and, in support of my assertion relating to the capability of coal-burning engines, built in accordance with Mr. Beattie's patent, consuming their own smoke, I have to observe, that a goodly number of them are at work on different lines of railway, and testimonials of their efficiency have very frequently been given.

(To be Continued.)

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*Association for the Prevention of Steam Boiler Explosions.**

At the usual monthly meeting of the committee of management, held on Wednesday, at the office of the secretary, Mr. Henry Whitworth, Corporation street, Manchester, the chief inspector, Mr. H. W. Harman, presented his monthly report, from which the following are extracts:—The following is a statement of our position as regards the number of works and boilers under the inspection of the association,

* From the Lond. Mining Journal, No. 1231.

for the month ending the 18th March, 1859:—530 mills and other works, and 1466 boilers, being an increase since the 22d ult., of 50 mills and other works, and 139 boilers. We have also made 230 visits and examined 667 boilers and 500 engines. Of these, two visits have been special, and one boiler specially examined, also 11 internally, and 27 thoroughly examined: 84 diagrams have been taken from 49 cylinders; 8 diagrams from 4 cylinders have been special. The usual copies, with calculations of power, consumption of fuel, and general recommendations, have been forwarded to proprietors. The number of boilers found to be defective are as under: corrosion, 20, of which 6 were dangerous; fractures, 3; safety-valves overweighted and otherwise out of order, 31; pressure gauges out of order, 20; water gauges out of order, 17; feed apparatus out of order, 5; blow-off cocks out of order, 9, of which 1 was dangerous; deficiency of water, 2; total 107. 10 boilers were without glass gauges; 28 boilers were without blow-off cocks; 3 boilers were without pressure-gauges; 7 safety valves had the spindles passed through stuffing boxes.

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*Stephenson and Alderson.**

I have waited to see whether any one would point out the fallacy of Stephenson's statement (*Athen.* No. 1633, p. 217,) that either iron or ice will bear a weight passing over it at a greater velocity, which it could not bear if it went slower; and that "when it goes quick, the weight in a manner ceases." The very reverse of this is the truth, as was clearly established by the "Iron Commission," which was appointed a few years since, to inquire into the causes of the breaking down of the iron bridge over the Dee. And the principle so established is now universally acted upon throughout our railways; the speed of the trains, upon approaching bridges of any considerable length, whether of iron or wood, is usually slackened to 8, 6, or even 4 miles an hour, according to circumstances; and the same rule, viz., of going slow, and not of going quick, is always observed in passing over an unsound part of an embankment. I was myself present at some very interesting experiments made by this Commission at the iron bridge of the South-Eastern Railway, near Epsom, in the presence of Lord Wrottesley, Sir W. Cubitt, the Astronomer Royal, and several others. Prof. Willis had contrived a very ingenious apparatus, which, fixed to the centre of one of the iron girders, measured and registered the deflection of the bridge at the passing over of any weight. An engine with a heavily-laden tender was then passed over the bridge at speeds varying from 10 to 60 miles an hour, and it was found that the greater the speed the greater was the deflection of the girder. K. A. W.

* From the London Athenæum, Feb. 26, 1859.

AMERICAN PATENTS.

List of American Patents which issued from May 17 to June 7, 1859, (inclusive,) with Exemplifications.

MAY 17.

181. Cotton Pressers; E. H. Adams, Talladega, Alabama.

Claim—The combination and arrangement of guide rod, toggle levers, connecting rod, lever, and rack lever, all operating in the manner set forth.

182. Surgical Splints; David Ahl, Newville, Pennsylvania.

Claim—A splint, made of the ingredients, and in the manner set forth.

183. Stencil Brush; V. R. Allen, St. Louis, Missouri.

Claim—The mode of making the handle of the brush in two parts, and fastening the two parts by means of a screw, turned on the wedge (which I term a wedge-screw), which is driven through the bristles in the iron band, thereby wedging the bristles in the band, and enabling the main handle to entirely cover the ends of the bristles and band, which prevents the handle and bristles, when in use, from working through the iron band holding the brush together.

184. Cut-off Gear of Steam Engines; E. R. Arnold, Providence, Rhode Island.

Claim—1st, The combination of an adjustable cam or sector, or its equivalent, located on the rock shaft; a stop-block, or its equivalent, and an arm, or its equivalent, attached to the devices which lift the valve—the three so combined operating to regulate the cut-off of the steam, in its passage into the engine, at any desired point of the stroke. 2d, The same combination above specified, for the purpose of working the exhaust valves of a steam engine, by means of the same rock shaft and eccentric motion with which the steam valves are operated.

185. Variable Exhaust of Locomotive Engines; Wm. S. G. Baker, Chicago, Illinois.

Claim—The plug, arranged in combination with the shell, and with the exhaust pipes of a double cylinder steam engine, in such a manner that the exhaust of each cylinder can be varied while both are separate from each other.

[This invention consists in arranging over the exhaust pipe a rotary cylindrical plug, with different sized openings, which are brought to correspond with the openings in the exhaust pipe and with the openings of the pipes leading therefrom to the chimney by means of gear wheels, which are easily operated from the engineer's stand, and the whole is so arranged that the steam from the two cylinders is kept separate until it reaches the chimney, and that the opening of the exhaust pipe for each cylinder is raised separately.]

186. Sewing Machines; Abraham Bartholf, City of New York.

Claim—Applying the said lever to work on a fixed fulcrum, in combination with a friction clamp, which, though it permits the said lever to be moved by and with the needle arm or needle carrier, during a portion of the movement of the latter in either direction, for the purpose of drawing back the thread through the cloth, and completing the stitch, and letting it slack again to form the loop of a succeeding stitch, holds the said lever in a positively stationary condition during the first part of the movement of the said arm or carrier in either direction, and so prevents the thread getting slack till the needle has entered the cloth, and prevents its being drawn up through the cloth till the heel of the shuttle has arrived at the loop. And in combination with the thread-controlling lever, operated by the needle arm or needle carrier, I claim the stationary eye made adjustable relatively to the said lever.

187. Seeding Machines; E. O. Baxter, Foreston, Illinois.

Claim—1st, The clearers formed of the bars, i i, placed on the seed tubes, connected with the bar, I, and operated through the medium of the lever, J, or its equivalent. 2d, The frame fitted to the axle, in connexion with the cams interposed between the axle and the frame, so as to raise the frame when desired, to throw the seed-distributing device out of gear with the driving wheel. 3d. The arrangement of the frame, lever, N, connected with the frame by the rod, and the upright on the draft-pole, for the purpose of regulating the depth of the furrows.

188. Artificial Legs; Douglas Bly, Rochester, New York.

Claim—1st, Curving or deflecting the jointed extremities of the bars, so as to bring their axes of motion back of their line of direction. 2d, The cord and spring acting upon the parts, D and L, in the manner set forth. 3d, I am aware that metallic springs have been employed to similate the functions of the natural muscles; but experience has proved their inadequacy, both as respects the results obtained and their durability. I am also aware that india rubber or elastic cords have been used for the same purpose, and with no better results, and these I do not claim—but I claim the combination of the non-elastic tendon with the india rubber spring, in such a manner that the required effect is derived from the compression and expansion of the material, and not from its elongation and contraction.

189. Sewing Machines; A. H. Boyd, Saco, Maine.

Claim—The employment of lever, I, a shoe and shoe-shaft, spring, plate, and sliding bar, with an under feed-plate, the shoe and the feed-plate having an intermittent, direct, horizontal, reciprocating motion, and the shoe having an intermitting, direct, vertical, reciprocating motion.

190. Apparatus for Cooling Beer; James Boyle, Roxbury, Massachusetts.

Claim—The combination with two or more vessels containing a series of tubes inserted in diaphragm plates, so arranged as to allow communication from the upper part of each vessel to the lower part thereof, and vice-versa, by means of and through the said tubes or pipes, so arranged on either side of the diaphragm as to connect the said vessels alternately at the top and bottom thereof; and of a pump or any suitable device for forcing beer, or any other liquid to be cooled down, through one set of tubes and up the other, while a supply of cold water surrounding said tubes is forced in a direction opposite to that of the liquid contained therein.

191. Drill Stock; M. S. Brooks, Chester, Connecticut.

Claim—The arrangement and combination with a spiral or screw-shaped shaft of a tube, ratchet, and stop within the socket, as described.

192. Plug for Blasting Rocks; J. D. Buckley and S. F. Mosher, Schaghticoke, New York.

Claim—The combination of the tapered screw with the expanding metallic plug, having ledges, or other equivalents, to penetrate the rock, and provided with an aperture for the fuse.

193. Machinery for Hardening Hat Bodies; George E. Cowperthwaite, Danbury, Connecticut.

Claim—The method of hardening hat bodies by means of a cradle, sustained in an inclined position, and having a tremulous movement. Also, the method of subjecting hat bodies to greater or less pressure during hardening, by inclining the cradle of the hardening machine to a greater or less extent.

194. Rocking Toy; J. A. Crandall, City of New York.

Claim—The flat-wound springs, pole or bar, elastic string, pin or thumb-screw, or their equivalent, in combination with the box and frame.

195. Machine for Upsetting Tire; C. L. Crowell and Robert Smith, Peoria, Illinois.

Claim—The combination of the lever and the intermediate slide, for the purpose of giving movement to the sliding jaw.

196. Drawing Heads for Spinning Machines; James E. Crowell, Chelsea, Massachusetts.

Claim—So constructing and gearing the two pairs of drawing rollers, that each pair will draw and release the sliver or roving, and so allow the twist to pass and run back to the first rollers.

197. Soap; William Dawes, Washington County, Tennessee.

Claim—The use of the ingredients, when combined in the proportions set forth.

198. Tuyere; George W. Dean, Glenn's Falls, New York.

Claim—The adjustable rotating chambered cylinder, arranged with the slot in the bed-plate, and relatively with the blast pipe, to operate as set forth.

199. Cultivators; Oliver H. Dennis, Altona, Illinois.

Claim—The arrangement and combination of the hinged handles, hinged side beams, B B, and connecting bars, in relation to the central beam, A, for the purpose specified.

200. Straw Cutters; J. B. Drake, Goshen, Indiana.

Claim—The arrangement of the hinged, forked, feeding pawl frame, feeding and stop pawls, centrally arranged ratchet wheel, spiked feed roller, and rising and falling knife frame.

201. Lamps; John L. Drake, Cincinnati, Ohio.

Claim—1st, A wick tube for containing two or more flat wicks, one at least of which wicks is a conductor, said tube having a double chamber, brace, and opening, as stated, so that the burning wick may receive the oil from the conductor, and still be free to move upon or against it, as it is raised or lowered, to regulate the burning. 2d, In combination with a slotted and perforated dome, and a flat wick for burning heavy oils, an auxiliary flat wick and wick tube.

202. Apparatus for Evaporating Saccharine Juices; Daniel I. Durfey, Croton, Ohio.

Claim—1st, A descending series of evaporating pans, each having a well or depression on the side next its immediate successor in the range, closable by sluices. 2d, The arrangement of the sluices alternately on the right and left of the range, when used in the described combination with the wells or depressions referred to. 3d, The strainer, in the described combination with the clarifier, operating in the manner set forth.

203. Water Indicator for Steam Boilers; John L. Frisbie, Cincinnati, Ohio.

Claim—1st, The described combination and arrangement of the box, adjustable pipe, valve, sleeve, and sector, operating in connexion with the float arm, for the purpose of varying the point of alarm from the outside of the boiler. 2d, The cogged sector provided with a segmental slot, in combination with the sliding sleeve, float arm, and bolt, to enable the application of the alarm to any part of the boiler.

204. Nut Cracker; Russel Frisbie, Middletown, Connecticut.

Claim—The nut cracker, substantially as described.

205. Water-wheels; Omri C. and Jarvis O. Ford, Collinsville, Connecticut.

Claim—The application of the reversed curved buckets or guides, to form a reversed action centrepetal and centre vent turbine water-wheel, in combination with the inner and outer cut-off.

206. Straw Cutters; A. W. Fox, Athens, Pennsylvania.

Claim—1st, The arrangement of the wheels, or their equivalent, in connexion with the crank, connecting rod, sliding frame, and shafts, by which I obtain an accelerated upward and retarded downward motion to the knife of a straw cutter. 2d, The combination of the sliding frame, with the knife sliding in the said frame, by means of the action of the angular slot and roller, or their equivalent, by which combination of parts a drawing cut is given to the knife, without interfering with the attachment and operation of the connecting rod, communicating motion from a shaft placed crosswise to the machine.

207. Arrangement of Key-board for Pianos, &c.; Alfred Gould and Cyrus Marsh, Seneca Falls, New York.

Claim—The arrangement of two, three, or more ranges of keys of the key-board, in the manner and in relation to each other, substantially as specified.

208. Sewing Machines; Joshua Gray, Medford, Massachusetts.

Claim—1st, The combination of the reciprocating bar with its side inclines and upper incline, with the bar, stop, and adjustable stop, arranged as described. 2d, In combination with the slide bar which operates the feeder, the bent lever, and universally adjustable cam.

209. Weighing Scales; Wm. D. Guseman, Morgantown, Virginia.

Claim—A pendulum drum or roller, which has, in addition to a rolling motion, a traveling movement. Also, in combination with a rolling and traveling drum or roller, and an index, a traveling vernier or dial. Also, the combination of the horizontal levers of a platform scale with the pendulum drums and bands.

210. Machine for Roasting Coffee; Josiah D. Harrington, Rochester, New York.

Claim—1st, The construction and arrangement of the divided handle, whereby the crank not only serves to hold the two halves of the ball together, while rotating, but also to lift up one-half of the ball when moved into the position shown. 2d, My method of uniting the two halves of a coffee-roaster, by means of the hinge formed of the curved jaw attached to one-half of the ball, and passing into a slot in the second jaw, said slot having the pin beneath which the curved jaw passes.

211. Mode of Applying Lever Power; Elijah Harris, Princeton, Illinois.

Claim—The use of a weight, a single or double lever, axle, and pivots, acting in combination with the circular plate, ratchet-clicks, and ratchet wheel, in applying lever power to machinery.

212. Cotton Press; Joseph Hawthorn, Thomas Co., Georgia.

Claim—The combination of the screw, the tap-block, and the levers, with the packing cases and their followers.

213. Sewing Machines; Albert H. Hook, City of New York.

Claim—The combination of the cam, lever, and spring, arranged as set forth.

214. Cooking Stoves; Sherman S. Jewett, Buffalo, New York.

Claim—The bricks, when constructed, arranged, and supported within the stove, for the purposes of an oven, as described.

215. Machine for Manufacturing Picket Fencing; Wm. W. Johnson, Clarksburgh, Virginia.

Claim—1st, Operating a series of twisters by means of pulleys and cords, arranged so as to give a twist and reverse twist to the wire, in combination with vibrating fingers, hollow shafts, and tension plates, or their equivalents. 2d, The segmental roller, constructed of the pieces, r r′ r″, for the purposes explained.

216. Adjustable Canopy for Railroad Cars; Isaac E. Jones, Cincinnati, Ohio.

Claim—The combination of springs, covers, and hinges, arranged in the manner set forth.

217. Centrifugal Gun; Wm. Joslin, Cleveland, Ohio.

Claim—1st, Arranging the barrel upon the same shaft with cog-wheel, which is secured near the periphery of the plate, and revolving the barrel around the wheel. 2d, The combination of the bevel and spurr gear wheels with the plate and barrel. 3d, The arrangement of the slide with the barrel and bevel table, for the purpose of elevating the balls to the barrel. 4th, The arrangement of the revolving hopper, bottom plate, and cylinder, for the purpose of conveying the balls down to the barrel.

218. Pumps; Albert B. Keeley and James S. Beck, Philadelphia, Pennsylvania.

Claim—The combination of a solid or valveless oscillating piston with the peculiar shaped piston chamber, and with the upper and lower valves.

219. Breast Plate and Perspiration Shields; Henry C. Lester, Brooklyn, New York.

Claim—The combination of the arm-pit shields or protectors and breast pads, substantially as described.

220. Railroad Frogs; David D. Lewis, Tamaqua, Pennsylvania.

Claim—The steel point dovetailed to the body of the frog, in combination with the tread-plate and the block, when the said tread-plate overlaps and is riveted to the said point, and when the block is of such a tapering or wedge-shaped form that, during the process of riveting it and the tread-plate to the body of the frog, the said block may serve the purpose of driving the point tight up into its socket.

221. Ventilating Hats; Arthur Maginnis, Philadelphia, Pennsylvania.

Claim—The combination of the perforated hat body, the perforated sweat leather, and the intervening corrugated band, when said band is provided with corrugation upon its two sides, and made plain and smooth on its rear and front.

222. Filterer and Purifier; Robert A. Maingay, Pottsville, Pennsylvania.

Claim—1st, The combination of the lime water hopper, agitator, turbine, and hogshead. 2d, The combination of the alkali keg, hogsheads and turbine. 3d, The arrangement and combination of the purifying and filtering hogsheads, filtering tank, turbines, purifier, and alkali kegs or hoppers.

[The mine water of coal regions is found, by analysis, to be strongly impregnated with carbonic acid, sulphuric acid, large quantities of alum, and sulphate of iron. These properties, as may be well known, render it very destructive to steam boilers and other apparatuses used about mines. The object of this invention is to deprive the water of these destructive properties, and at the same time filter it so that it will be useful for mechanical and domestic purposes. The nature of the improvement consists in a peculiar arrangement of a series of purifying and filtering hogsheads, a large filtering tank or reservoir, a series of purifying kegs or hoppers, and a series of turbines.]

223. Anti-friction Support for the Backs of Rudders; Albert H. Manchester, Providence, Rhode Island.

Claim—Supporting the rudder from behind by means of a backer or brace rising from the deck, or attached above it, having rollers in its face, constructed as described.

224. Gas Retorts; Alfred Marsh, Detroit, Michigan.

Claim—The employment of the secondary lid, for the purposes set forth, when the same is arranged and connected with the feed pipe.

225. Composition for Emery Sticks and Wheels; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—The composition for the manufacture of emery wheels, sticks, and tools, of more or less flexible nature, formed of gutta-percha or india rubber, and sulphur, emery, and olive oil.

226. Machine for Sawing Beveled Surfaces; John McDiarmid, Brooklyn, New York.

Claim—The employment of the oscillating frame, in combination with the centre wheel, central flanch, and saw or cutters, constructed in the manner described.

227. Metallic Seals; Charles A. McEvoy, Richmond, Virginia.

Claim—The use of a paper label, or its equivalent, in combination with a metallic seal.

228. Seeding Machines; Charles Messenger, Warren, Ohio.

Claim—The lever, b, arm, c, levers e, and spring, in combination with a combined seeding machine and ground roller. Also, the studs, rods, and shaft, in combination with the cams, when used in connexion with the seeding machine and ground roller combined.

229. Screw Excavator; Richard Montgomery, City of New York.

Claim—1st, Making the cylinder, which encloses the screw, in a conical form, for the purpose of rendering the ascent and discharge of the earth more free and perfect. 2d, Supporting the cylinder and screw by means of the hinged frame. 3d, Driving the cylinder and screws by means of the gearing, arranged as described. 4th, Supporting and adjusting the front of the excavator by means of the friction ring and chain or rope. 5th, The curved swinging standard or derrick for elevating the front end of the excavator without

unfastening the chain, when desired. 6th, The combination of the cylinder and screw with the swinging frame, derrick, and carriage.

230. Extension Ladder; Joel Moulton, Boston, Massachusetts.

Claim—The improved extension ladder hose carrier, constructed with a series of single ladder bars, connected together and provided with pins or handles, and having not only an extension line and sheaves connected with and arranged in them (the said bars), as explained, but a supporting platform and guide braces, arranged at the upper part of the upper bar. Also, the combination and arrangement of the water conduit or hose pipe director and its guiding lines with the extension ladder.

231. Metal Drills; Jacob Murphy, Half Moon, Pennsylvania.

Claim—The shoulders on the drill, in combination with the braces and pin upon the sliding frame.

232. Machine for Rolling and Measuring Cotton Bagging; Thomas H. Murphy, New Orleans, Louisiana.

Claim—The combination for simultaneously rolling and measuring bagging, consisting of an adjustable guide bar, sliding shaft, fitting into driver, the windlass and cord, adjustable pressure roller, carrying cam, lever, indicating wheel, arm, pawl, and spring.

233. Machines for Husking Corn; Jacob Naeher, North Orange, New Jersey.

Claim—The reciprocating troughs, one or more, provided with pincers, in connexion with the toothed plates or stripping combs, and with or without the retaining plate.

234. Metallic Frames for Window Blinds; Charles Neer, Albany, New York.

Claim—Constructing frames for blinds of sheet metal, bent in a U form, and connected together as specified. Also, the bent or folded strips, provided with holes receiving the ends or tenons of the slats.

235. Mop Handle; H. and J. S. B Norton, Farmington, Maine.

Claim—Attaching the mop cloth or yarn to the handle and to a slide fitted on the handle.

236. Manufacture of Bricks; Nelson Parmeter, Gardner, Massachusetts.

Claim—A fire-proof brick or lining, composed of the above named ingredients, in the proportions set forth.

237. Signal Door Bolt; Charles Page, West Meriden, Connecticut.

Claim—Passing the pin which moves the bolt through the door, and permanently fixing to the projecting extremity thereof a segmental plate, so as to overlay the fixed symbol plate, and communicate the desired intelligence.

238. Machine for Planing and Shaving Ice; H. D. J. Pratt, Washington City, D. C.

Claim—The machine or implement for cutting or reducing ice to small particles, as described, the same consisting of the arrangement in a hopper of suitable size and shape of rotating cutters, with or without a presser.

239. Cultivators; Asa Preston, Unionville, Ohio.

Claim—The construction of a combined plough cultivator, having the several parts so arranged that they can be easily attached or detached when said plough has the hinged wings, mould-board, bars, and blades, arranged as set forth.

240. Water-wheels; Reuben Rich, Albion, New York.

Claim—Constructing the pen-stock, dadoed joints, and bolts, in combination with gates, and centre scroll plate, and wheel, constructed in the manner specified.

241. Water-wheels; Sylvanus Richardson, Jericho, Vermont.

Claim—The float with hinges, as shown at point marked a, and the spiral or curved form of the lower part of the float, as shown at points marked b, combined with the extension downwards of the case below the scroll case, and with draft tube.

242. Washing Machine; John R. Rogers, Sacramento, Wisconsin.

Claim—The combination in cylinder of the diagonal slats with the two heads of the cylinder, when said heads are provided with holes of such a shape and form that they will collect and force the water in, and empty it at alternate ends of the cylinder, as the direction of its revolutions are changed.

243. Water-wheel; Timothy Rose, Cortlandtville, New York.

Claim—Forming the buckets of four parts, arranged or disposed relatively with each other, the hub, and annular plate, and with a scroll, specifically as described.

[This is an improvement on that class of water-wheels which rotate in a horizontal plane, and are acted upon and propelled both by the impacting and re-acting force of the water as it passes through the wheel.]

244. Cast Iron Grinding Mills; John Russell, Troy, New York.

Claim—1st, The combination of the breaker and internally armed hopper with the upper grinder and lower grinder, for the purpose of feeding into the mill and grinding large substances, such as corn on the cob. 2d, Making the armed portion of the hopper of separate rings provided with internal projections, and arranged and secured together in the mill, as set forth. 3d, Making the lower grinder of separate toothed rings, arranged and secured together upon the supporting plate. 4th, Making the upper grinder of separate toothed rings, arranged and secured together in and to the supporting plate.

245. Seeding Machines; Thomas Short, Danville, Illinois.

Claim—The swinging frame, when provided with a seed-distributing device actuated by a wheel and cutting furrow shares, and fitted within a mounted frame.

246. Refining Iron in the Hearth of a Blast Furnace; Christian Shunk, Canton, Ohio.

Claim—The employment of an auxiliary tuyere pipe within the hearth of the common blast furnace, when charged with molten iron, at such an angle as that the blast of air entering the iron may strike the circular wall of the hearth, as nearly as possible, at a tangent to its circumference, so as to cause the blast of air to pass round in the metal, giving the whole mass in the hearth a spiral motion immediately before the tapping of the furnace for the manufacture of pig iron from the ore.

247. Sewing Machines; James C. Spencer, Phelps, New York.

Claim—The construction of a feeder and needle bar in one piece or connected together, and the combination of the eccentric and pin with the needle bar, by means of the slot.

218. Harvesting Machines; Wm. S. Stetson, Baltimore, Maryland.

Claim—1st. Connecting the finger bar to the frame of the machine by means of the saddle and its support. 2d, In combination with the saddle, the swiveling guide and swiveling lever. 3d, Throwing the cutters in and out of gear by means of a shifting bar.

249. Harvesting Machines; W. S. Stetson and R. F. Maynard, Baltimore, Maryland.

Claim—1st, The double hinge joint at the end of the finger bar, consisting of the hinge shaft, collar, and brace. 2d, The compound connecting rod. 3d. So constructing or forming the upper part of the obtuse angle iron tooth bar and the base of the finger or tooth, that said base shall bear upon two plain faces of the said angle iron, in the manner set forth.

250. Foot Power Machine; Frederick S. Stoddard, Litchfield, Connecticut.

Claim—1st, A two-throw crank, operated by one pitman, in combination with a lever and spring, or their equivalents. 2d. The mode of attaching the spring to the foot-piece to operate on the pitman crank, in connexion with the set-screws for adjusting and reversing the motion.

251. Potato Planter; J. C. Stoddard, Worcester, Massachusetts.

Claim—1st, The combination of the compound cam, hooked lever, and sliding crosshead, with cotter attached. 2d, Arranging the plough-shares and covering shares on parallel rock shafts, so that a lateral and vertical adjustment can be given to the same.

252. Stop-gauge for Weather Boarding, &c.; Worden E. Stoddard, Horicon, New York.

Claim—The use of the bar forming a stop or support for boards and mouldings, and the knob, the spur, and the adjustable slide.

253. Paddle-wheel; John Thompson and M. L. Doty, Carlton, Iowa.

Claim—The buckets of a paddle-wheel, arranged in combination with the segments, the weighted pinions, and the dogs, or their equivalents. And in combination with the above named parts, the arrangement of the spurs, or their equivalents, for the purpose of retaining the buckets in the proper position while the wheel is backing.

254. Propeller; Charles R. M. Wall, City of New York.

Claim—1st, An apron, arranged in such relation to a wheel that it operates to propel a vessel. 2d, The arrangement of the rollers in combination with the apron, whereby the wheel is made to work at any dip. 3d, The springs or their equivalent, arranged in combination with the rollers and with the apron, for the purpose of regulating the strain on the apron.

255. Needle-case and Index; Calvin D. Wheeler, City of New York.

Claim—A needle-case and index combined for sewing machines, whereby the appropriate sizes of the thread and needles to properly work together is always determined.

256. Seeding Cultivators; Nicholas Whitehall, Newtown, Indiana.

Claim—The combination of the stirrups with the notched handles, eye bolts, and hooks, by which I am enabled to raise and secure the plough at any desirable height.

257. Cements for Roofing; J. Carpenter Worth, Little Britain Township, Lancaster Co., Pennsylvania.

Claim—The composition for roofing made up in the manner and of the ingredients proportioned and mixed, as set forth.

258. Pump; John H. Young, St. Louis, Missouri.

Claim—Dividing the pump cylinder into two chambers by the division valve seat plate, with its valves opening upwards, and uniting them by the water way, as described. Also, the puppet valves, connected to, and operating with, the buckets in the two chambers, so that, whilst they move with said buckets, they shall have action independent of them. Also, in combination with the hollow piston and stem passing through it, the causing of the upper valve to close upwards against its bucket.

259. Railroad Switch; Jacob Youngman, Sunbury, Pennsylvania.

Claim—The arrangement of two guards, so that a space exists between them at the point where the cars take an oblique direction to the switch rails, in order to run upon the lower portion of the main track on a frog plate which has stationary frogs and a rail arranged on it.

260. Lock; Orson Billings, La Grange, Ohio, Assignor to self and Morris Traver, Clinton Hollow, New York.

Claim—The combination of the guards or plates arranged relatively with each other and the bolt, to operate as set forth. Also, the spring tops when applied to the guard or plate, and the latter is used in connexion with its fellow guards, for the purpose described.

261. Hand-planing Machine; Tyrannus B. Butterfield, Indianapolis, Assignor to Abijah Taylor and R. Stevenson, Morgan Co., Indiana.

Claim—The combination and arrangement of the frame, knife, feed roller, spring, and screw.

262. Window Sash Supporter; Sumner Cooper, Windsor, Connecticut, Assignor to self, Thomas Denham, and Joseph W. Briggs, Cleveland, Ohio.

Claim—The combination and employment of the spring pinion pulley, with the rack or perforated plate, tube, or box, pin, key, and latch.

263. Connecting together the Braces of Truss Bridges; L. E. Truesdell, Warren, Massachusetts.

Claim—The method described of constructing and interlocking the diagonal braces.

264. Feeding Device for Planing Machines; C. B. Cottrell, Assignor to self and Nathan Babcock, Westerly, Rhode Island.

Claim—The combination of the anti-friction and feed rollers, applied to the class of planing machines described, and driven from one and the same shaft by gearing, arranged to admit of a separate lateral adjustment of each.

265. Machine for Shaving Staves from the Bolt; Harry H. Evarts, Assignor to self and P. E. Merrihew, Chicago, Illinois.

Claim—1st, The employment or use of the reciprocating saws in connexion with the swinging bolt frames, operated by the wiper wheels, or their equivalents. 2d, The employment or use of the segment racks, connected by the pinions with the right and left screw rods, having jaws placed thereon, for the purpose of dogging and undogging the bolts at the proper time.

266. VALVES FOR DRY GAS METRES; Henry Howson, Assignor to A. Harris and J. W. Harris, Philadelphia, Pennsylvania.

Claim—1st, A pin, or its equivalent, fitted loosely to the valve, and intervening between the valve and the driver. 2d, Constructing the driver in the form of an inverted cup, with driving pins in the inside, said cup being so arranged in respect to the annular flanch of the valve, as to serve the double purpose of maintaining the latter in its proper position, and of preventing the access of tar to the driving pins.

267. SEWING MACHINES; Warren Millar, Assignor to self and John Nutt, Chicago, Illinois.

Claim—1st, The hook, as described, in combination with an eye-pointed needle and the spool case. 2d, The combination of the flanch and space, or their equivalents, of the spool case. 3d, The sliding supports, or equivalents therefor. 4th, Imparting to the spool case the tripping or rocking motion, to receive the loop of needle thread from the hook, or its equivalent, in the manner described.

268. CORN AND COB MILLS; Wm. Sailor, Assignor to self, William S. Boyer, and H. K. Boyer, Philadelphia, Pennsylvania.

Claim—1st, The plates with their saw teeth, when the said plates are secured obliquely on the spindle and adjacent to the burr, and when both the burr and plates are arranged in respect to the shell, as set forth. 2d, Forming the burr in three or more separate pieces, adapted and secured to each other and to the spindle, as specified.

269. VINEGAR CRUET OR BOTTLE; George W. and George H. Simmons, Bennington, Assignors to selves and Norman Millington, Shaftsbury, Vermont.

Claim—A bottle, cruet, or other similar vessel, for containing liquids for table, culinary, or household purposes, provided with the tubes, A and B, made and fitted to them in the manner described.

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270. SHOE FOR GRAIN SEPARATORS; Hiram Aldridge, Michigan City, Indiana.

Claim—The endless incline elevator belt with its lags or cross slats, in combination with the incline sieve or board and incline extension board.

271. BEDSTEAD FASTENING; G. W. Baker, Cochranton, Pennsylvania.

Claim—The box, the hook, and the rack, when combined in the manner described.

272. SMUT MACHINES; E. Barnhart, Shippensburg, Pennsylvania.

Claim—The disc arranged with the fluted shell and with the wings, to operate in combination with the fluted cylinder, which is provided with a spout.

273. SURFACE CONDENSERS; Daniel Barnum, City of New York.

Claim—The method of making yielding joints between the tubes and tube sheets in the condensing water compartments of surface condensers, and of thus compensating the expansions and contractions in the tubes, by the means of leaving a portion of india rubber, or other elastic packing, immediately surrounding each tube free, so that its elasticity can yield longitudinally with the tubes and compensate for their varying lengths, without causing the packing to slip on the metal. Also, the combination of a relief valve with yielding joints (without followers) in the condensing water compartments of surface condensers, for the purpose of preventing the blowing out of the packing, and thus preserving the joints.

274. HEMMING GUIDES FOR SEWING MACHINES; Daniel Barnum, Jersey City, New Jersey, and S. G. Tyler, Quincy, Illinois.

Claim—The manner of arranging and constructing a hollow conical U-shaped tube and slot, in combination with a horizontally acting spring plate, or its equivalent, bearing against the slot, and tending to press the edge of the flexible material, when the same is placed within the slot into the tube, and against the lower side of the concave surface thereof, for the purpose of aiding the hand in turning the hem on the underside, and leaving the fair stitch upon the upper or right side of the garment.

275. CULTIVATORS; J. W. and Leonard Batson, Clarksville, Maryland.

Claim—The arrangement of the reversible concave shovel point, H, reversible shovel point, F, and the cutter, with beam and standards, in the manner described.

276. RIG FOR VESSELS; Thomas Bell, City of New York.

Claim—The arrangement and combination of the mast, spar, and revolving forked mast bench, as described.

[The mast of a vessel and its spar or spars are combined in such a manner that the mast turns with the spar or spars, and all the sail spread on the mast is caused to have a similar lifting action on the vessel; the mast is also attached to the vessel in a novel manner.]

277. SPRING BED BOTTOM; Ezra R. Benton, Cleveland, Ohio.

Claim—The construction of a bed bottom or spring couch, consisting of a series of double springs, the longitudinal pieces, and the transverse slats, either with or without the flexible band, arranged as set forth.

278. CARDING ENGINES; John Boyd, Philadelphia, Pennsylvania.

Claim—The combination of the rollers and scrapers, for stripping the ordinary doffing cylinder of a carding engine, as described.

279. HARVESTING MACHINES; C. B. Brinkerhoff, Batavia, New York.

Claim—1st, The combination of the crank, operated by the main shaft, with the rake and sweep post, to which it is attached, and the eighth arm. 2d, The open work divider to divide the grain falling upon the platform from the gavel being removed therefrom by the rake, when arranged upon the rake-head, in the manner specified. 3d, The spring catch and dog in combination, and the location of said catch, to break the forward motion of the rake and its return by the spring. 4th, The projection on the lower side of the slot or notch in the dog to arrest the catch with certainty. 5th, The application and arrangement of the toothed rack connected with the spring, by which the rake is caught and held after its descent upon the gavel, the rebound thereof is prevented, and the gavel removed with greater certainty. 6th, The placing of a rake (having spring teeth) in the rear of the machine, for the purpose of gleaning and contracting the gavel sheaf into form. 7th, The combination of the cam attached to the main shaft, with the arm of the rear rake, to cause it to pass over the gavels at the proper time. 8th, The ratchet cam and lever in combination, for throwing both rakes into or out of action.

280. Apparatus for Heating Feed Water of Steam Boilers; J. T. Brooks, New Albany, Indiana.

Claim—The relative arrangement of the force pump, water supply pipe, heater, and steam pipe, conveying steam from the upper part of the boiler or steam dome to the heater, to heat feed water on its passage betwe o the pump and the boiler, by means of living steam, and inject it into the lower region of the boiler.

281. Harrows; R. W. Buckles, Grayville, Illinois.

Claim—Two harrows hung to one frame, independent of each other, with two vertical toothed wheels also working independently of each other, and connected to the horizontal wheels, which are actuated by means of pinions.

282. Ox-yokes; Washington Burnham, Essex, Massachusetts.

Claim—The mode of applying the pole ring to the yoke, namely, by means of the staple rack and the ring carrier, made so as to be capable of sliding on the rack, and with a pin passage arranged with respect to the notches of the staple rack, as described.

283. Curtain Rack; J. F. Calhoun, Wolcottville, Connecticut.

Claim—The combination of tightening screw, collar, pulley, and button, for effecting the required tension on the cord.

284. Sewing Machines; P. S. Carhart, Collamer, New York.

Claim—Feeding the cloth by the combined action of the needle and friction pad, when the said needle and pad operate jointly and in unison to propel the cloth, as the needle descends therethrough, the cloth being held in its required position by the needle during the intervals of feed, while the pad is retreating to take a fresh feeding grip on the cloth.

285. Bread Knife; Joseph Carrier, Marlborough, Connecticut.

Claim—The employment of the roller and the adjustable studs with the collars and thumb-nuts, as described.

286. Stove Pipes; M. C. Chamberlin, Johnsonburgh, New York.

Claim—1st, The employment of the spring tube in connexion with the pipe, in the manner specified. 2d, The arrangement of pipe, c, provided with pin, with pipe, a, provided with slot, a, and spring tube, in the manner specified.

287. Horse Power Machines; A. B. Colton, Athens, Georgia.

Claim—1st, The stationary wheel and its hub, when the same are placed centrally with the large driving wheel, for giving motion to the pinions and gear wheels, revolving with the driving wheel, so as to impart a rapid rotary motion to the horizontal shaft, having its bearings in the axes of both driving wheel and stationary wheel. 2d, The sectional yoke, in combination with the annular collar and set-screws.

288. Joiners' Bench; J. E. Cryer, Peoria, Illinois.

Claim—1st, The movable jaw, a, arranged with reference to the permanent jaw, b, in such manner as to secure properly the lumber to be wrought, and at the same time to form a track or guide for the plane during the operation of jointing and squaring lumber. 2d, Operating the jaw, f, by means of guides, rod, lever, and dog. 3d, The gauge, adjustable vertically, with reference to the jaws, b b, in combination with the scale.

289. Carpet Sweeper; Henry Davis, Bethlehem, Connecticut.

Claim—The arrangement of the rollers to operate in combination with the yielding brush and with the scraper.

290. Hominy Machines; Wm. Davis, Middleburg, Maryland.

Claim—Providing the outer cylinder with apertures gauged to such a size, as while serving to discharge the hulls also to perform the additional function of discharging the hominy, as soon as reduced to the desired degree of fineness, in combination with the inner cylinder, when the same is driven at the specific speeds, as described.

291. Compositions for Roofing; J. M. Day and E. H. A. Oakley, Aiken, South Carolina.

Claim—The ingredients in the proportions set forth.

292. Mill-stone Bush; M. DeCamp, South Bend, Indiana.

Claim—1st, The adjustable followers provided with convex sides and backs fitted within an oil-box, and arranged in relation with the collar of the spindle, to operate as set forth. 2d, The serrated or notched wheels, attached to the outer ends of the screws, when used in connexion with the stops attached to the plates, as specified.

293. Chimney Caps; Charles Douglas, Hebron, Connecticut.

Claim—1st The valves, and the manner and the position in which they are suspended. 2d, The arrangement of the neck, the top, and the standards, in combination with the valve, or its equivalent.

294. Dry Gas Metres; Samuel Down, City of New York.

Claim—Constructing or arranging the mouths of the channels of communication between the inlet and outlet pipes, and the measuring chambers and valve chamber of a dry gas metre, to dip down in the wells below the said pipes, as set forth.

295. Railroad Car Couplings; Christian H. Eisenbrandt, Baltimore, Maryland.

Claim—The plates with the springs, the prong-grasping grippers, with the spring latch, constructed as set forth. Also, the hitching pin or bolt, provided with the chain and button or ring, when used in combination with the clasping prong grippers and brake lever, as set forth. Also, the combination and arrangement of the sliding belts with the prong-clasping grippers, as set forth.

296. Device for Securing Lightning Rods; John A. Enggren, Brooklyn, New York.

Claim—An insulator for lightning rods, composed of a glass standard, a spring clasp, having shanks, and shoulders, and otherwise made as described.

297. Device for Clamping the Bolts in Circular Sawing Shingle Machines; Kasson Freeman, Fond du Lac, Wisconsin.

Claim—The arrangement of the sliding or adjustable block with weights attached, or their equivalents, when used in connexion with the sliding jaws.

298. Ties for Cotton Bales; Edward Garrett, New Orleans, Louisiana.

Claim—The combination of the two plates, &c., when arranged to form a tie for iron bands for baling cotton, or for similar purposes.

299. Trunk Lock; E. L. Gaylord, Terrysville, Connecticut.

Claim—The arrangement of the bolt with the springs and tumbler, to operate as set forth.

300. Horse Rakes; Elisha Geiger, Lancaster, Pennsylvania.

Claim—The arrangement of the cross-bar, having the flat springs and heads, and provided with arms for actuating the supporting bar with and in relation to the clearing rocker shaft.

301. Cases for Stereoscopic Pictures; Henry Glosser, City of New York.

Claim—1st, The arrangement of two or more pairs of eye-glasses on the same side of a stereoscopic case, so that several persons can look at the pictures at one and the same time. 2d, The picture frames, arranged with cogs, or their equivalent, at their lower edges, in combination with the cams, j j′ j″ j‴, or their equivalents, whereby the same are made to travel from one pair of eye-glasses to the other. 3d, Giving a double motion to the picture frames, first in a direction transversely through the case by the action of the cam, g, or its equivalent, on the endless belt, E; and second, in a longitudinal direction by the action of the cams, j. 4th. The arrangement and combination of the endless belts, E E′, to operate in relation to the channel, o, substantially as described. 5th, The cams, g g‴, arranged in combination with the cams, j j′, &c., or their equivalents, in such manner that they produce the within described motion of the picture frames at alternate intervals.

302. Washing Machine; Arthur Gray, Naples, Maine.

Claim—The improved washing machine, as made with a set of fluted rollers and a fluted presser or backing-board applied to the reservoir, as described, in order to enable the clothes to be both rolled and beaten during the operation of washing the same.

303. Steam Boilers; Benjamin L. Griffith, Hazel township, Pennsylvania.

Claim—The combination of the single smoke-stack, single chamber, and double series of flues, with the hollow-hinged doors and diaphragms, arranged as set forth.

304. Piano-forte Action; Napoleon J. Haines, City of New York.

Claim—The cross-shaped or four-armed fly, applied in combination with the jack, the key, and the hammer butt, to operate as set forth.

305. Machine for Filing Saws; A. Hadley, Lynn, Massachusetts.

Claim—1st, Determining the bevel of the teeth of a straight saw, by means of pivoting the frame (which supports the rail and saw-plate,) at h, and hinging rods, to said frame, and confining these rods in their relative position by set-screws. 2d, Determining the bevel of the teeth of a circular saw by arranging the shaft of the saw between two points, l and m, one of the points, m, being adjustable by means of a grooved piece, block, and set-screw. 3d, Determining the bevel of the straight and circular saws by combining the frame with grooves, forming arcs of a circle, in combination with clamp screws and slotted plates. 4th, Holding the file by clamps, r″ r″, set-screws, o″ o″, in combination with shaft, n″, set-screw, p″, and bracket, m″, constructed in the manner set forth. 5th, The combination of the movable table with the mechanism for supporting and moving the saws, constructed and arranged thereon as described, whereby the same machine can be quickly adapted for filing either straight or circular saws. 6th, The combination of the mechanism for supporting and moving the saws with the mechanism for supporting and operating the file.

306. Hubs for Carriage Wheels; Luther T. Hazen, Coventry, New York.

Claim—Enclosing wood hubs for carriage wheels, or other vehicles, with metal cases which form the pipe box and bands, in the manner described.

307. Machine for Raising Railroad Truck; Wm. Henney, Wapello, Illinois.

Claim—The balance, arranged with the arms and with the extensions to operate in combination with the piston, the serrated bar, the pawl, and with the eccentric disc, in the manner described.

308. Ovens; John F. Hoffmeister, Alton, Illinois.

Claim—The arrangement of the flues which terminate in the chamber, in combination with the additional flue, to operate in combination with the rotary platform, as specified.

[A rotary platform is arranged over the flues which convey the heat from the fire-place, and the heat is carried by two other flues (uniting into one,) over the platform, so that the dough which is placed on the platform is exposed to a considerable and uniform heat during the first half of its rotation, and to a less heat during the latter half of its rotation, and so a loaf of bread, or other article, is well baked after it has been once rotated on the platform.]

309. Clothes Dryer; C. R. Hurlbut, Yorkshire, New York.

Claim—The arrangement of standards side rails, cross rails, and sash, provided on their under side with buttons, the whole being jointed, and the several parts acting conjointly in the manner specified.

310. Coolers for Beer; Charles Jones, Brooklyn, New York.

Claim—The shell arranged in the cooler, so as to form the two compartments, to operate in combination with the coil, as described.

311. Manufacture of Water-proof Cement Pipes; Alfred Fauvin Jaloureau, Paris, France; patented in France, December 30, 1857.

Claim—The manufacture of air and water-tight tubes or pipes by the process set forth.

312. Separators for Smut Machines; G. P. Jordan, Burlington, Iowa.

Claim—1st, The combination and arrangement of the scourer with the spout, chamber, and box, provided with the blast chambers, spout, H, fan, and screens. 2d, The employment or use of the valves placed in the partition plates, when used in combination with the fan, chamber, spout, D, and scourer, and arranged relatively therewith, as set forth.

313. Churn; William Kelly, Hastings, Michigan.

Claim—The combination of the dashers with the slide partition and connecting rods, the parts being so connected to the frame that the oscillations of the churns shall operate the dashers, and force the cream against and through the slide partition—not intending to claim the operation of the dasher or dashers by the oscillations of the churn, but only the combination and arrangement of the vibrating dashers with the movable partition and concomitant parts, as described.

314. Harvesting Machines; Jesse Little, Chambersburg, Pennsylvania.

Claim—The arrangement of the sliding brace, in combination with the tongue and bar, constructed and operating in the manner described. Also, the combination and arrangement of the caster plate, jaws, and segments, in the manner described.

315. Propelling and Steering Apparatus; Murdick Lythe, Alleghany, Pennsylvania.

Claim—1st. The shaft, b, with a supporting arm or arms and bearing recess, in combination with the propeller or paddle-wheel shaft, a, arranged in the manner set forth. 2d. The tubular shaft, c, with gear wheels at the upper and lower ends, in combination with the shaft, b, and propeller shaft, K, arranged in the manner set forth.

316. Propeller; Levi H. Markley. Line Lexington, Pennsylvania.

Claim—The arrangement and combination of the peculiarly acting paddle blades or fliers, pivoted frame, rods, hooks, sliding block, and reversing and bracing bar, as described.

317. Method of Forming Plough Handles; George W. Matthews, York, Pennsylvania.

Claim—The arrangement and combination of the carriage provided with the patterns or curved surfaces, the adjustable rotating cutter head, belt, and adjustable shaft, provided with the pinion and the rack attached to carriage.

318. Metallic Pipe; W. S. Mayo, City of New York.

Claim—The application of longitudinal strips to the surface of a metallic pipe, in combination with the coiled wire covering, whereby I am enabled to insure great strength with a less thickness of metal.

319. Bag Fastener; Wm. P. Maxson, Albion, Wisconsin.

Claim—The employment of the oblong grooved faced plate, or its equivalent, having two segments of its middle portion punched out, so as to admit the string and fasten it to the bag, in combination with the string and ring, when constructed to operate upon the principle of the wedge.

320. Egg-beater; Thomas McBean, Fowlerville, New York.

Claim—The double spiral dasher, in combination with a square box, where the same are arranged substantially as specified.

321. Seed Planters; John McKown, Geardstown, Virginia.

Claim—The arrangement for united operation of the horizontally-moving hand lever, vertical shaft, horizontal elbow lever, horizontal slides, divided hopper, seed tube, and vacuum plate, as set forth.

322. Seats and Couches for Sleeping Cars; Thomas E. McNeil, Philadelphia, Pennsylvania.

Claim—1st. Two adjacent seats, each seat having detachable cushioned boards, G and E, and each having a permanent end frame and a rear frame, with upper and lower ledges, in combination with the swing bracket and rib, or their equivalents, arranged so that the cushioned boards, G, of the two adjacent seats may form one couch, and the boards, E, of the same seats another couch, and so that when the said boards are arranged as couches there may be a space between them and the permanent end frames. 2d. Constructing and arranging the end frames of four seats, so that they may serve as supports for the cushioned platforms, which form the two intermediate berths.

323. Attaching Thills to Axles; John Miller, Bucyrus, Ohio.

Claim—The adjusting and securing the hook on the pin, by means of the circular face on the jaws, and the shoulders on the iron.

324. Threshing Machines; John R. Moffit, Piqua, Ohio.

Claim—The described arrangement of fixed bearings, set-screws (in the line of adjustment), and hinged concave heads, the whole operating together to set and rigidly retain the toothed portion of the concave at any desired proximity to the threshing cylinder, while at the side at which the unthreshed grain enters, its distance is substantially unchanged.

325. Machine for Dressing Kid Skins; Timothy Newhall, Lynn, Massachusetts.

Claim—The rotary brush, in connexion with the reciprocating bed or carriage connected with its guide rods by springs, the parts being arranged to operate as set forth.

326. Smut Machines; T. A. Noble and Erastus Coy, Akron, Ohio, and James B. Angell, Alleghany, Penna.

Claim—1st. The adjustable hoop, in connexion with the increased chamber, f, to regulate the blast passing up through the circular opening, N, also the adjustable ring, D, to regulate the blast coming up through the circular opening E; the operation in both cases being to increase or diminish the blast, as may be required. 2d. The chamber, G, in combination with arm, F, and spout, L, when said chamber is placed above the revolving chamber, H, to catch the screenings. 3d. The revolving chamber, H, provided with sides and rim, for distributing the wheat evenly as it falls over the edge of the rim so as to be more effectually operated upon by the blast passing up the opening, E, and also the flanch, M, upon cylinder, L, for the similar distribution of the wheat to the second blast rising through opening, N. 4th. Making the conical scourer adjustable perpendicularly, both independently of shaft, A, and disc, I, and in connexion with said shaft and disc.

327. Machines for Cutting Soles; John S. Shattuck, Malden, Massachusetts.

Claim—The alternating or vibrating segment carrying the two cutters, having the toe and heel in opposite directions. Also, the yielding table which supports the leather as it is fed forward and the yielding gauge by which the leather is brought to the right position to be operated upon by the cutters. Also, the projecting knife-edge at the heel and toe of the cutter, by which the scraps are detached from the strip of leather.

328. Folding Cradle; L. K. Selden, Haddam, Connecticut.

Claim—1st. The rockers of a cradle arranged with slats, or their equivalents, and operating in combination with the bottom braces, the upright cross-bars, the longitudinal bars, and the top bars, in the manner specified. 2d. The arrangement of the slides, in combination with the bottom braces, and with the upright cross-bars, to operate as described.

329. Straw Cutters; George Roushe, Lima, Ohio.

Claim—The relative arrangement for united operation in a straw cutter of the reciprocating cutting knife, when arranged in a circularly-moving frame, reciprocating feeding rake, and rising and falling pivoted press-board.

330. Platform Scales; Elnathan Sampson, St. Johnsbury, Vermont.

Claim—Attaching the rails of the platform direct to the sleepers, which are connected at each end by links to yokes fitted on levers, the lower ends of said levers, at each side of the platform, being connected together and to the shaft of the scale beam by rods. Also the employment or use of the adjustable rods attached to the levers, to permit of the compensation of the same, for the purpose specified.

331. Buckles; Adolph Roesler, Warsaw, Illinois.

Claim—The tug plates, the trace-plate, having one or more knobs, the fork-shaped hame hook, and screw-rod, all arranged as described.

332. CAR COUPLINGS; Richard Rickkon, Rochester, New York.

Claim—Constructing self-adjusting car couplings with a series of grooves, so so as to admit of the coupling (with self-couplers) of cars of unequal heights.

333. BURNERS FOR VAPOR LAMPS; Robert Ramsey, Philadelphia, Pennsylvania.

Claim—The combination of the wick tube, the gas chamber, the tube, and jet, arranged as described.

334. STOVES; Richard B. Pullan, Cincinnati, Ohio.

Claim—A rotating vessel provided with two grates, and a central row of grate-bars, arranged within stoves in such manner as to form two fire chambers, one above the other, and which may be used alternately.

335. MACHINE FOR STRIPPING AND CUTTING SUGAR CANE FOR GRINDING; Luther E. Porter, Lake Mills, Wis.

Claim—1st, The divided clasp, arranged as described. 2d, In combination with the above, I claim the spring cutters, arranged as described.

336. METALLIC SHIELDS FOR BOOTS AND SHOES; Jonah Platt and Myron D. Brooks, Akron, Ohio.

Claim—The construction of boot and shoe shields having an opening in front to prevent water or sand from being entrapped between the shield and the leather.

337. SEATS FOR CHURCHES, SCHOOLS, &c.; Charles Perley, City of New York.

Claim—The combination of the swinging bracket with the turning seat, connected and acting in the manner specified.

338. CHUCK FOR SCREW-CUTTING; Richard Nuttall and John Kirkpatrick, Alleghany, Pennsylvania.

Claim—1st, The ring having a portion of the inside cut away or recessed for the purpose of making room for the outer end of the cutting dies, said ring being furnished with cams on the inside, and with a spring catch, lever, cam, and locking stud on the outside. 2d, The cam chamber in the die-box, when used in connexion with the cams and ring. 3d, The regulating stud when made in three parts, and used in connexion with the die-box, ring, and spring catch. 4th, The combination and arrangement of the die-box, cutting dies, and cap, with the ring, the whole being arranged as described. 5th, The eccentric lever on the face-plate, when used in combination with the lever, cam, locking stud, and spring catch, as described.

339. MACHINE FOR CUTTING SCREWS; Richard Nuttall and John Kirkpatrick, Alleghany, Pennsylvania.

Claim—1st, The combination and arrangement of the levers, rods, stops, and springs, with the holding or sliding head and eccentric lever, in the manner described. 2d, The use of the sliding or holding head and eccentric lever, when used for the purpose of opening and closing cutting dies in chucks for screw-cutting.

340. SPRING BALANCE FOR WINDOW SASH; F. H. Smith, Plainville, Connecticut.

Claim—The manner of securing the pulleys in the head jamb of the window frame, and the manner of winding up and adjusting the two pulleys through one orifice.

341. COAL SCREEN; Jasper Snell and John R. Deihm, Pottsville, Pennsylvania.

Claim—The arrangement of the plates or blades in parallel planes with spaces between their edges, so as to slope lengthwise of the screen and crosswise from the centre of the screen.

342. FRICTION PULLEYS; Edward Spalding, Wesborough, Massachusetts.

Claim—The combination of the tubular rest with the driving pulley, the hanger, or its equivalent, and the shaft of the driving pulley, the pulleys being arranged and made to operate with respect to one another, as specified.

343. SAILS FOR FORE-AND-AFT RIGGED VESSELS; A. Washington Stewart, Cambridge, Maryland.

Claim—In fore-sails the clue-sail, of the form specified, united to the after-leach of the fore-sail, and managed by sheets, as set forth.

344. SEED PLANTERS; Stephen L. Stockstill, Medway, Ohio.

Claim—The described arrangement of the open notches, pivot, drag-bar, and pin, constructed in the manner set forth.

345. MECHANISM FOR VARYING SPEED; James A. Stoddard, Milford, Massachusetts.

Claim—Graduating or varying speed by means of pulleys, or their equivalents, operated in connexion with surface wheels, or their equivalents, in such manner as to receive and transmit the motion at variable distances from their centres, when constructed and operating substantially in the manner set forth.

346. PORTABLE WAGON JACKS; Henry Stowell and Lorenzo Spencer, Placierville, California.

Claim—The peculiar arrangement, combination, and adaptation for the purpose of raising the axles of wagons, and other heavy bodies, to which the foregoing invention may be adapted.

347. WEIGHING SCALES; Francis M. Strong and Thomas Ross, Brandon, Vermont.

Claim—The employment of an auxiliary frame, in combination with, and interposed between, the platform and levers. Also, constructing such intermediate frame in two parts, connected by movable joints at the angles. Also, the manner of constructing and inserting the bearing blocks that rest on the knife edges. Also, bringing the ends of the arms immediately one above the other, in combination with the mode of connecting the two with the beam by single and double connecting rods, substantially as described.

348. PLATFORM SCALES; Francis M. Strong and Thomas Ross, Brandon, Vermont.

Claim—Arranging the series of rocking levers which sustain the platform, with their shafts all parallel, and with the arms of all of them in the same line, except those constituting the inner section, which are inclined, in combination with the transmitting lever above, which connects with the scale beam, to the short arms of which they are all suspended at equal distances from the axis of vibration. Also, the method of connecting the several sections of the shaft of the transmitting lever, by means of projections and links, for the purpose of enabling it to yield freely to inequalities or variations in the supports, that it may vibrate freely and without binding, and thereby transmit the weight accurately to the scale beam, as described. Also, suspending the bearing blocks by two links, in manner substantially as described, so that any swinging motion of the levers will not cause the blocks to vibrate on the knife-edges, by which means we are enabled the better to preserve fine knife edges, so essential to accurate weighing. Also, constructing the bearing pieces with convex face and projecting tenon, whereby they are rendered self-adjusting, that the knife edges may bear without binding. Also in combination with the nose-iron, adjustable by a screw in the end of the transmitting lever, the employment of a spring bearing against the end of the adjusting screws.

349. Machine for Cutting Irregular Forms; Isaac T. Tice, Baltimore, Maryland.

Claim—The employment or use of the vibrating bed with fence or gauge and feed or pressure rollers, attached in connexion with the rotary cutter head fitted in stationary bearings on the platform or table, the whole being arranged as set forth.

350. Sugar Cane Harvesters; Robert R. Taylor, Reading, Pennsylvania.

Claim—The two sets of rotating cutters, one set being situated above and in advance of the other set, in combination with the reel and shield, as set forth.

351. Machine for Cutting Soles; John Thompson, Marblehead, Massachusetts.

Claim—The arrangement and application of entire sole-cutters (viz: such as are capable of cutting out an entire sole, finished on its sides, toe, and heel,) on opposite sides of a rotary shaft, so that after each semi-revolution of such shaft, and during each descent of it, an entire sole, with heel and toe complete, may be cut from the piece of the leather by one of such sole-cutters acting thereon, and while the piece of leather is supported on the bed or block under such shaft. Also, the application of the catch and cams to the pinion, and a spring slider applied to the shaft, and so as to operate therewith, as specified. Also, in connexion with the entire sole-cutters applied to opposite sides of the shaft, and operated as described, a gauge, and mechanism to operate it in such manner as first to move it up to the path of the cutter, and carry it away therefrom sufficiently to enable the sole that may have been cut to be discharged from the supporting bed.

352. Rocking Chair; Thomas H. Tatlow, Jr., Palmyra, Missouri.

Claim—A rocking chair, having its arms extended down to the rockers, and its back arranged and operated as specified

[This invention consists in extending the arms of the chair down behind the seat to the rockers, so as to form a circular arc, the under edge of which is provided with saw teeth, which serve to retain the back in any desired inclination, by means of a rod with two rectangular bends at each end, which rod is attached to the back, and the bends of which are forced into the saw-teeth attached to the extension of these arms, by means of springs.]

353. Reefing Fore and Aft Sails; James L. Townsend, Newburyport, Massachusetts.

Claim—The application of the gaff to the mast, so as to be capable of being dropped downward, on either side of the sail, into or about into parallelism with the mast, as specified, in combination with the application of one or two head reefing lines to the gaff and the sail, so as to enable the slack of the leach and upper part of the sail to be taken up, and also the lower end of the gaff to be secured, in order to effect the reefing of the sail. Also, in combination with the said means of reefing the head and producing the lap of the sail, one or more buntlines or lap-securing lines, applied to the leach and the body of the sail, as described.

354. Moulding Machine; Chapman Warner, City of New York.

Claim—1st, The method of packing the sand by dropping it from any given height. 2d, The mode of obtaining the same result by means of revolving bladed shafts, as described. 3d, The double-hinged flask, constructed and secured by plates and pins, as described 4th, The table, constructed substantially as described, under and independent of the moulding board, capable only of a vertical motion communicated to it by the arrangement described, or any one equivalent thereto, and working in connexion with the moulding board, through which latter the patterns, which are fastened on the table, protrude. 5th, The mode of supporting the moulding board from beneath and through the table. 6th, The combination of apparatus for packing the sand with the mode of hinging and securing the flask by plates and pins, and with the vertically working table apparatus for withdrawing the patterns from the sand through the moulding board, supported as described.

355. Ring Traveler Spinning Frame; Joseph W. Wattles, Canton, Massachusetts.

Claim—The improved arrangement of the ring flanches by which the traveler is supported, and on which it slides, the same consisting in arranging them with reference to the ring or its axis, substantially as shown.

356. Harvesting Machines; Jesse Whitehead, Manchester, Virginia.

Claim—1st, The supplemental discharging rake arranged with its actuating mechanism, as described, so as to operate automatically and conjointly with the platform rake. 2d, Attaching or suspending the rake-head to the shaft, by means of the pulley, d, rod, oblique bars, and pulley, h, as described, whereby the head is allowed to vibrate, and is perfectly guided or retained on the shaft.

[Letters Patent were granted to this inventor on December 2, 1856, for an automatic raking attachment, on which this is an improvement.]

357. Cultivators; W. I. Wilson, Franklin, Indiana.

Claim—The arrangement of axles, wheels, levers, shanks, ploughs, cross-pieces, guides, and arms, for operating conjointly in the manner set forth.

358. Saw Filer; Solon Wood, White Pine, Pennsylvania.

Claim—The arrangement of the cutters on an arbor, the bearings of which are so arranged that the cutters are subjected to the action of adjustable spiral springs, or their equivalents, in the manner specified. Also, the additional arm which is hinged to the bar, in combination with the sliding pieces, for the purpose of allowing the cutters to follow the action of the springs in two directions, as described.

359. Gong or Bell for Signals; Isaac F. Woodward, Philadelphia, Pennsylvania.

Claim—The escapement bar, constructed as described, in combination with the end and pin of the hammer or striking arm.

360. Machines for Making Clay Pipes; Henry Aregood, Mansfield Township, New Jersey, and Stephen Ustick, Philadelphia, Pennsylvania, Assignors to John L. Macknight, Bordentown, New Jersey.

Claim—1st, The annular ring upon the core pin (which is also provided with a foot), in combination with a flanch upon the inside of the outer front end of the mould, to retain the core pin in place while forming the bell end of the pipe, operated in the manner specified. 2d, The cam wheel, in combination with the piston, trough, and its connexions, mould, and core pin, for making the bell end and straight part of the pipe at one operation. 3d, The combination of the rock shafts with the two halves of the mould, the former being operated by the cam wheel and shaft, for the purposes described. 4th, The slide, rod, and cam strip, as described. 5th, The arrangement and combination of the cam, rock shaft, and levers, for operating the knife, in the manner specified.

361. Wrench; Henry J. Behrens, Assignor to Charles S. Pomeroy, City of New York.

Claim—Providing the socket of the screw with a pivot or hinge, substantially in the manner specified.

362. CARPET SWEEPER; Wm. G. Budlong, Assignor to Hamilton W. Conklin and James W. Corning, Hartford, Connecticut.

Claim—In combination with the gear wheel and pinion at either end of the case, the lever, and screw, by which the height of the brush is adjusted and the pinion is engaged with the driving gear.

363. BURGLARS' ALARM; John G. Clark, Assignor to self and Samuel W. Hatch, Augusta, Georgia.

Claim—1st, The employment of one or more cap nipples on a suspended gravitating breech piece or plate, to receive a percussion cap or caps, when said breech piece forms part of a burglars' alarm. 2d, Providing said suspended breech piece or plate with a vertical stem, and arranging to slide over said stem a tubular weight, so that when the alarm detaches from the door and strikes the floor, the percussion force of the breech piece and weight will explode the cap or caps and produce the desired alarm. 3d, Arranging the spring on the stem of the breech piece, between the breech piece and weight, so that the same shall be held far enough apart to allow the necessary movement of the same toward each other to explode the cap or caps when the alarm strikes the floor. 4th, Providing serrations on the under side of the suspending bracket, so that said bracket shall move with the door until it clears the framing.

[This is a little device to be carried in the pocket by travelers. On going to bed it is attached to the door by pushing a bracket in between its upper edge and the upper part of the frame. From the bracket the alarm is suspended by means of a chain above the floor. When the door is opened the bracket detaches and the alarm falls to the floor. The concussion of the breech piece, which carries percussion caps, with a descending weight explodes the caps and produces an alarm, thereby warning the sleeper of the approach of burglars.]

364. APPARATUS FOR COOKING BY STEAM; H. W. Horton, Wheaton, Assignor to Oliver H. Horton, Chicago, and Roswell E. Adams, Wheaton, Illinois.

Claim—The described arrangement of a steam boiler, in combination with a steam chamber, which communicates with a boiler by means of a slide, or its equivalent, and one end of which contains the oven.

[This invention consists in arranging over a closed space formed in the lower part of a box with a flat bottom, a steam chamber, which communicates with the boiler by means of a slide which can be operated from the outside, and part of which forms a separate compartment or oven smaller than the chamber, so that when the chamber is filled with steam the oven will be surrounded by it, except where the door is the whole being so arranged as to cook articles in the steam or in dry air, and that the oven serves for baking.]

365. HOSE COUPLING; N. N. McLeod, Assignor to Carroll E. Gray, St. Louis, Missouri.

Claim—Making the lip around the conical end, so as to leave a cavity to receive the end of the pipe and the screw nut, when the said lip is a part and portion of the same piece that the cone is, as described.

366. WATER-PROOF SOLE; John W. Smith, Washington City, D. C., Assignor to self and Walter W. Perry, Baltimore, Maryland.

Claim—As a new article of manufacture, the water-proof inside sole, when constructed of the compound above described, placed between two sheets of paper, in the manner set forth.

367. SPLINT BROOM; John W. Wheeler, Assignor to Alden B. Stockwell, Cleveland, Ohio.

Claim—The formation of brooms composed of separate wrought splints, when constructed in the manner described.

368. MACHINES FOR CHANNELING AND EDGING SOLES OF BOOTS AND SHOES; Martin Wesson, Assignor to self and D. B. Wesson, Springfield, Massachusetts.

Claim—1st, The combination of the feed rolls, adjustable knives, and the guide, when constructed substantially in the manner set forth. 2d, The combination of lever, sliding pieces, and knives, when arranged as described, and forming a knife-holding arrangement.

369. CIRCULAR CLAMPS FOR SEWING MACHINES; Stephen G. Tyler, Assignor to self, G. J. Saage, and J. W. Barnum, Quincy, Illinois.

Claim—The combination of a central disc with the convex clamping disc and the flat sustaining disc, for the purpose of dividing the crown and quarters of circular sewing, and presenting the edge of the fabric to the needle, in the manner set forth.

MAY 31.

370. SPRINGS FOR RAILROAD CARS; George M. Alsop, Philadelphia, Pennsylvania.

Claim—1st, The method or arrangement of inclosing an air-tight vessel filled with air in a box or chamber, with a flexible water-proof cover or diaphragm, and surrounding the air vessel with water, or some other suitable fluid. 2d, The arrangement of the convex steel plates which are divided into radiating leaves or segments, connected together at the centre, whose outer edges or peripheries rest upon and slide on the metal ring or plate, and in the recess in the bottom of the top, the whole being arranged for the purpose of forming a flexible metallic support or covering to the diaphragm, to prevent its being strained or ruptured. 3d, The combination and arrangement of the piston, its elastic cushion, the flexible steel plate or plates, metal plate or rings, and the diaphragm, arranged as described.

371. SEED PLANTERS; C. F. Anderson, Charlestown, New Hampshire.

Claim—The ratchet-shaped projections in the hub of wheel, and on the disc of the tube, in connexion with the tube provided with the spiral and straight grooves in which the projection of the tube is fitted—the tube having the side lever attached, and also the catch, the whole being arranged as set forth.

372. STRAW CUTTERS; Ensign Baker, Fredonia, New York.

Claim—1st, The employment or use of the leger knife, provided with the hook, actuated by the cam, and used in connexion with the knives attached to the wheel, and provided with the hooks. 2d, The arrangement of the crank spring with rack attached, and the ratchet on the shaft of the feed roller to feed the stuff intermittently to the knives, as described.

373. TOBACCO PRESSES; John A. Bawsel, Powhattan Court House, Virginia.

Claim—1st, The use of the follower fitting into the groove of the opposite roller. 2d, The springs, as constructed and operated for guiding the tobacco and straightening the leaves as they pass between the rollers. 3d, The use of the treadle, in combination with the springs and with the rollers for separating the springs, and also for separating the rollers, as set forth. 4th, The oil cup and roller in connexion with groove, for oiling the groove and the tobacco.

374. ELEVATORS FOR HOISTING GOODS IN WAREHOUSES; Albert Betteley, Boston, Massachusetts.

Claim—So arranging and combining a rider with a brake, by the means described, or their equivalents

as to operate on a drive-pulley to check or prevent its rotation whenever the driving belt breaks or is removed.

375. FREIGHT CARS; Joseph D. Billings, Rutland, Vermont.

Claim—Placing a metal shoe, single or continuous, between the studs or sheathing boards and sills of railroad cars, for excluding the water, and thereby preventing the rapid decay of the same.

376. WRENCH; John W. Brewster, Stamford, New York.

Claim—A wrench having a six-sided handle, stationary jaw, and sliding jaw, with apertures of the precise form shown.

377. MACHINE FOR PUNCHING METAL; Jay H. Brown, Grand Ledge, Michigan.

Claim—The application and use of the bars, in combination with lever, punching bar, frusto-conical rollers, rod, and spiral (or equivalent) spring, for the purposes specified.

378. PUMP GEARING; John P. Carr, Mattapoisett, Massachusetts.

Claim—The device, as set forth and described, for operating pumps on board of ships, and in other places where said invention may be useful.

379. STOVES; Frederick Bucher, Columbia, Pennsylvania.

Claim—In combination with the fire cylinder, the double radiators, each inclosing an interior chamber and register, so that the draft may be direct or checked at pleasure in its passage through the stove, by which means I obtain much radiating surface and economize much fuel.

380. JOINERS' CLAMP; John Clackson, Milford, Pennsylvania.

Claim—The clamp formed of the bar, with the jaws arranged and fitted on it, substantially as described.

381. COMPOSITION FOR PENCILS; E. P. Clark, Holyoke, Massachusetts.

Claim—The composition for pencils for indelible writing, made by combining nitrate of silver with the several other ingredients herein specified.

[The marking inks so commonly used for marking linen, or other fabrics, are inconvenient and troublesome, each bottle being accompanied by a number of "directions," which considerably bother the brains of housekeepers. This pencil will prevent all this, as all the preparation necessary is the damping of the fabric which is to be marked, when the pencil, which is composed of nitrate of silver, nitric acid, glue, lampblack, and sugar, will leave an indelible mark thereupon.]

382. MACHINE FOR GRINDING SAWS; William Clemson, East Woburn, Massachusetts.

Claim—The elliptical bearings, lever, and double gearing, in combination with the adjustable bearing plates, arranged as specified.

383. CHURN; Jacob Closs, Decatur, Indiana.

Claim—The use of the screw dashers, constructed as set forth, in connexion with the wings.

384. CORN CRUSHERS; T. B. Coursey, Frederica, Delaware.

Claim—The employment or use of the serrated flanches placed obliquely and eccentrically on the shaft, in combination with the crushing heads and shell.

385. GAS REGULATORS; E. Hall Covell, City of New York.

Claim—1st, The combining of the rotary pump or air-forcer with the air receiver and its fluid valve arrangements, in the manner set forth, whereby the one controls the action of the other, and through their joint action the charging apparatus is controlled. 2d, Connecting the commingling chamber of the charging apparatus with the air receiver, for the purpose set forth.

386. HYDRO-CARBON VAPOR APPARATUS; E. Hall Covell, City of New York.

Claim—1st, Constructing the apparatus, for the purposes set forth, of detachable parts or chambers. 2d, The arrangement of the feed pipes or tubes and outlet pipes, whereby I am enabled to pass in the material to any one of the chambers, or to let out material, and to examine the interior while the apparatus is in operation, and the process of charging going on.

387. RAILROAD CAR TRUCKS; G. F. Decker, Scranton, Pennsylvania.

Claim—The axles, of a truck, in separate or independent frames, attached to the bed-piece, and connected by a spring or flexible plate, and used in connexion with the spring.

388. HAND LEVER; Edward J. Durant, Lebanon, New Hampshire.

Claim—Combining the forked shaft with the sliding head-piece, the intermediate lever, and the hand lever, in such a manner as to form a compound leverage car-mover, that can be operated as set forth.

389. CULTIVATORS; Celestin Eastburn, Spencer County, Kentucky.

Claim—The arrangement of the ploughs, wheel, block, spring, and rake, as set forth.

390. MACHINERY FOR CRUSHING AND MIXING SUGAR; Fred. Ebelin, City of New York.

Claim—1st, The reciprocating plunger acting on the sugar-loaf, in combination with the revolving cutter-head, in the manner specified. 2d, The support and latch, actuated as set forth, and acting to drop one loaf of sugar at a time from the hopper, so as to be pressed forward by the plunger. 3d, The sliding bar fitted with the incline, in combination with the pins on the wheel, and the weight, or its equivalent, for drawing back the plungers, in the manner specified. 4th, The revolving mixers, constructed with slats between the heads, in the manner set forth.

391. MACHINES FOR DRYING FIBROUS SUBSTANCES; Jeremiah Essex, North Bennington, Vermont.

Claim—The manner herein specified of guiding an ascending and descending endless apron by the pulley, or their equivalents, acting on the edges of said endless apron.

392. LOOMS FOR WEAVING PLAIDS, &c.; Merrill A. Furbush and George Compton, Worcester, Massachusetts.

Claim—The employment of two sets of ratchet wheels and appendages, each set consisting of reversed ratchets, in combination with two sets of cams and two series of shuttle-boxes. Also, two sets of reversible ratchets and appendages, the two sets of cams, and two series of shuttle-boxes, in combination with one pattern chain or cylinder, in manner specified.

393. WASHING MACHINE; George Geer, Uniontown, Illinois.

Claim—A washing machine provided with a lever, cylinder of rollers, clutch, endless belt, adjustable levers, made as set forth, so that by shifting the lever the motion of the belt will cease, and hold the clothes

at rest beneath the rotating cylinder of rollers, and so that the belt may be loosened or tightened when desired, by shifting the levers.

394. TANNING LEATHER; Jacob Gove, Milford, New Hampshire.

Claim—Giving to the liquor or tanning fluid in the vat a rapid motion, commencing across the bottom of the vat and under the suspended hides, for the purpose set forth.

395. CONSTRUCTION OF PINS FOR SECURING ARTIFICIAL TEETH; John Hassell, Jr., Newark, New Jersey.

Claim—The splint-pin, used double or single, half round or flat, for the purposes set forth.

396. MEAT CUTTER; Henry Havell, Newark, New Jersey.

Claim—1st, The hook-pointed rotary knives, arranged in the described relation to the hopper. 2d, The combined arrangement of the stationary curved knives, latitudinal grooves, and rotary knives, as set forth.

397. RETORTS FOR DISTILLING COAL OILS; Robert W. Hazlett and John H. Hobbs, Wheeling, Virginia.

Claim—1st, Constructing the horizontal retort with a pan or flat-shaped base and inclined upper sides or top, and with open conduits or gutters running from end to end of the retort, and arranged on the inner sides thereof, and set inclining and emptying into the neck of the retort, the whole for united operation, as set forth. 2d, The drawer or charger when open at top, and in no way or at any time attached as a fixture to the retort, and yet serving during the distilling process as a part of the generating chamber, and being kept elevated above the bottom of the generating chamber, and allowed to slide in and out without the necessity of removing or disconnecting any portions of the retort or generator.

398. RETORTS FOR DISTILLING OIL FROM COAL; J. E. Holmes, Newark, Ohio.

Claim—The employment in a retort for distilling oil from coal, of a central perforated tube, suspended from the mouth-piece, an open space being also left below the bottom of tube, for the removal of the coke residuum through the mouth.

[This improvement consists in the employment, within an upright retort, and at or near the centre thereof, of a perforated tube, through which the vapors, or a great portion of them, can escape to the exit pipe as fast as they are eliminated, without being drawn or forced into contact with the heated sides of the retort, as the greater portion of the vapors are caused to do in the ordinary stationary retort, by the packing of the coal in the centre of it.]

399. WHEEL JACK FOR CARRIAGES, &c.; Henry Hooton, Massachusetts, and J. G. Bicknell, Cambridgeport, Massachusetts.

Claim—1st, The combination of the hollow box with the lever, the front jointed pawl, the back pawl, and the notched shaft. 2d, The combination of the button, E, the spring, the catch, the button, H, and the jointed connecting rod, as described.

400. DOOR LATCH; Mark Howland, Waterbury, Connecticut.

Claim—The specified relative arrangement for united operation of the latch, with female screw-threaded socket, latch guide plate, with square opening, latch shank or rod, with male screw-thread on its front end, stationary slotted guide case, shoulder on the latch shank or rod, spiral spring, sliding connecting link or plate, with cross-heads and double-acting knob-tumbler.

401. MODE OF SECURING CORKS IN BOTTLES; Robert W. Huston, Calais, Maine.

Claim—The metallic pieces which are hinged on a wire secured below the enlargement on the bottle neck, and which are provided with teeth with the strips, and with the wire and clasps, arranged in the manner specified.

402. SEWING MACHINES; A. B. Irving, Terre Haute, Indiana.

Claim—The arrangement relatively to one another of the following parts, to wit: the upper and lower feeding arms, upper and lower rack shafts, actuating cam, combining and regulating projection, and slotted adjustable spring holding down bar, for the purposes set forth.

403. RETORTS FOR DISTILLING OIL FROM COAL; Wm. G. W. Jaeger, Baltimore, Maryland.

Claim—1st, The side channels and the trap openings or discharge pipes for the heavy oils. 2d, In combination with said side channels, the double inclination or arched form of the bottom of the retort. 3d. In combination with the coal oil retort, constructed substantially as above set forth, I claim the opening, for the purposes set forth.

404. MACHINERY FOR TRANSMITTING MOTION; Mathans Kaefer, City of New York.

Claim—The arrangement of the carriage and fly-wheel, in such relation to the crank that the weight of the carriage and of the fly-wheel acts on the crank, in the manner specified.

405. FIELD ROLLERS; George Lindley, Chicago, Illinois.

Claim—The vibrating scrapers, constructed and arranged so that the driver can operate them to clear the rollers of the earth adhering to them, when the machine is drawn in either direction. Also, constructing and arranging the platform so that the ends which support it may vibrate freely under it, when the rollers pass over uneven ground.

406. CHURN; W. H. McClintock, Frankfort, Ohio.

Claim—The employment of the specified peculiarly constructed circularly vibrating suction and force-pump, in combination with a churn, constructed with a perforated partition.

407. SUCTION HOSE; Charles McBurney, Roxbury, Massachusetts.

Claim—The rings, operating in the manner set forth.

408. MODE OF CONNECTING AND DISCONNECTING MACHINERY BY MEANS OF A BELT; Tindal A. Madison, Terre Haute, Indiana.

Claim—1st, The combination of the shifting bar with the belt, the driving pulley, and the series of dead rollers, or their equivalents. 2d. The combination of the shifting bar and box with the gate or pawl, or their equivalents. 3d. The guide plate with its slot, in combination with the friction roller, or their equivalents, for the purpose of giving both forward and lateral motion to the belt, when moved from a state of rest. 4th. The series of dead rollers, for the purposes and arranged in the manner set forth. 5th, The lever, in combination with the slots, the stud, and connecting rod, for the purpose of operating the gate or pawl, in the manner described.

409. WATER-TIGHT SINK; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—The production of water-tight sinks formed from vulcanized india rubber or gutta-percha, substantially in the manner set forth.

410. Seats and Couches for Railway Cars; Thomas E. McNeill, Philadelphia, Pennsylvania.

Claim—1st, The end frame of the seat, with its slotted stop and the slotted plate secured to the side of the car, in combination with the back and its pins or bolts, when the several parts are adapted to, and arranged in respect to, each other, substantially as set forth. 2d, The arms, so hinged to the inside of the end frame as to be folded down under the seat during the day, and elevated so as to form supports for the couches during the night. 3d, The vertical frames hinged to the side of the car, and furnished with ledges to support two couches. 4th, The board, its rod, and the hangers, when arranged as set forth.

411. Device for Operating the Index of Time Registers; Robert McKenna, Rossville, Tennessee.

Claim—The moving of the pencil, in the manner described.

412. Harvesting Machines; John Macpherson, Pennington, New Jersey.

Claim—1st, The curved, slatted, flexible apron, when constructed in the manner set forth. 2d. The combination of the endless apron with the curved, slatted, flexible apron, arranged in the manner set forth.

413. Cultivators; R. M. Melton, Criglersville, Virginia.

Claim—1st, The combination of the adjustable links with the adjustable slide, arranged as described, for the purpose of adjusting the distance between the ploughs. 2d. In combination with the curved plough beam, the coulter, constructed and arranged substantially as described, whereby the draft of the side ploughs is regulated by sliding the coulter on the beam and firm support given to the coulter in passing through compact soil.

414. Lock for Repeating Fire Arms; J. R. Mock, Elizabethtown, Kentucky.

Claim—The use of the coiled spring, in combination with the sliding lock, the catch, catch spring, and grooved barrel, and grooved breech-pin.

415. Manufacture of Corrugated Beams; Richard Montgomery, City of New York.

Claim—The roller, A, with its peculiarly formed projections and recesses, in combination with the roller, B, with its peculiarly formed projections and recesses, arranged in relation to each other, as set forth. Also, the rollers, A and B, in combination with the former, C, said parts being arranged in relation to each other, as and for the purposes described.

416. Apparatus for Seasoning Lumber; M. R. Moore, Philadelphia, Pennsylvania.

Claim—The combined arrangement of the track rails, or their equivalents, with a steaming and drying chamber or vessel, fitted with steam pipes and stop-cocks or valves, so as to operate therewith, in the manner specified.

417. Broom; D. J. Owen, Springville Lynn, Pennsylvania.

Claim—A broom provided with a leather bag, spring, and otherwise made as described.

418. Cross-cut Sawing Machines; G. W. Parker, Fitzwilliam, New Hampshire.

Claim—The cross-head and the several parts attached to it, whether arranged as shown in Figs. 1 and 2, or as in Fig. 3, together with the piece, X, or its equivalent, to work the arms, V and N, to raise the saw and the handle, to hold the saw when raised.

419. Churn; J. R. Parker, Sing Sing, New York.

Claim—The combination of the rotating faces of the disk with the stationary faces, in the manner set forth.

420. Chairs for Railways; J. F. Peabody, Salem, Massachusetts.

Claim—The arrangement and application of rail bearers with respect to the elastic bearing, its cap plate, the base plate, and under the rails of the railway chair, and particularly with the elastic bearing and cap plate, arranged and protected by a recess, essentially as explained.

421. Mills; A. E. Pirkey, Bradford, Illinois.

Claim—The described arrangement of the adjustable slides and the corner pieces, to operate in combination with the piston which receives its motion by means of a lever and wheels, in the manner specified.

[The invention consists in a device by which the distance between the sides of the shell and piston can be regulated, so that the flour or meal may be brought to any desired state of fineness.]

422. Screw Dies; A. P. Pitkin, Hartford, Connecticut.

Claim—Making a screw plate, with both top and bottom parts which hold the die, cast or made on to the screw plate, in the manner described. Further, the making the inlet for the introduction of the die into its chamber, between the parts through the outside edge of the screw plate, as described.

423. Clover Hullers; Christian Reif, Hartleton, Lewis Township, Pennsylvania.

Claim—The projections at different angles on the concave, in combination with the spiral rows of projects on the cylinder, as set forth.

424. Nut Cracker; Ezra Ripley, Troy, New York.

Claim—The described nut-cracker or implement, consisting essentially of the fixed jaw, with its standard, the movable jaw with its slide, and the eccentric or cam with its handle and flanch, as described.

425. Sawing Machine for Re-sawing Boards; A. C. Ross, Almont, Michigan.

Claim—1st, The arrangement of circular saw and stationary divider, in connexion with a permanent horizontal bed in re-sawing machines. 2d, The bell-shaped flanches or sockets of the saws, constructed as described.

426. Self-acting Wagon Brake; Joseph Rosencrans, Avoca, New York.

Claim—The arrangement of means set forth, for operating the brake by the holding back of the team.

427. Stoves; George H. Russell, Baltimore, Maryland.

Claim—The combination, with the inner fire drum, of the cold air base, vertical side pipes, and elbow, with their dampers, cylindrical cover, or top drum, with its chambers and connecting tube, horizontal air-space and outlet, with air-drums, passage, front vertical register pipes, foot-warmer connecting pipes, and foot-warmer, with its register, ventilating registers, double smoke-pipes, with dampers, set as described, and divided outer smoke-drum, with its passage or passages, substantially as set forth.

428. Carpet Fastener; A. M. Smith, City of New York.

Claim—The combination and arrangement of the point, A, lips, b b, slot, c, bearing, d, lips, e e, point, f, hook, g, lips, h h, bearings, i i, as specified.

429. MANUFACTURE OF BELTING; Charles, E. Smith, Philadelphia, Pennsylvania.

Claim—The manufacture of continuous belting or boards by uniting pieces of band iron, by lapping and riveting two beveled ends, so as to produce a rhomboidal joint, in the manner described.

430. CORDAGE MACHINERY; George Stephenson, Northfield, Indiana.

Claim—The employment of a series of movable bearing cross-bars with side pivots or gudgeons, the ends of the cross-bars being supported by longitudinal slots or grooves in the flyer bars, and connected to each other by elastic straps or thongs, whereby the cross-bars are made to press gently upon the ends of the spools (which are mounted upon the side pivots), to resist slightly the rotary motion thereof, and also admit of the occasional removal of one or more of the spools, without disarranging others of the series, the cross-bars, spools, and elastic straps being arranged in the manner described.

431. AXLE-BOX FOR RAILROAD CARS; Levi Stevens, Fitchburg, Massachusetts.

Claim—A box made of anti-friction metal and backed with a casing of bronze, the bronze passing through the anti-friction metal, and resting upon the axle, for the purpose described.

432. CONDENSING STEAM ENGINES; John Sutton, Assignor to self and DeWitt C. Van Tuyl, City of New York.

Claim—1st, The arrangement of the combined air pump and condenser piston, K, to act independently of the walking beam of the engine, so that a portion of the exhaust steam, while the piston, P, is first completing and commencing a stroke, shall impart a full stroke to the piston, K, as described. 2d, The arrangement and combination of the forked levers, Q S, the crank, E, lever, R, and piston rod, K′, so that by the action of the piston, K, the crank, E, will be assisted in passing the dead points, but during other portions of the crank movement, the parts above named will be disconnected from the crank, E, as described.

[In this invention, the air pump and cylinder of a condensing engine are combined, and the cold water injection is so applied that condensation takes place in the air pump, and the use of a separate vessel as a condenser dispensed with. The air pump is operated by the direct pressure of the exhaust steam upon its piston, without any aid from any other part of the engine, and the surplus of power in the air pump over and above what is necessary for the discharge of the water of condensation from it is used to help the crank or cranks past the centres.]

433. MANUFACTURE OF WRENCHES; George C. Taft, Worcester, Massachusetts.

Claim—The peculiar mode of constructing the head and shank of screw wrenches, namely, by first forming or constructing the head and shank or bar separately, as described, and then uniting the head and shank after the shank has been inserted into the depression first made in the head by welding, the whole operation being substantially as described.

434. SEEDING MACHINES; T. H. Tatlow, Jr., Palmyra, Missouri.

Claim—1st, The employment or use of the covering hoe, operated from the supporting wheel through the medium of the rollers, bar, J, and the bars, F I, connected by the rod, H, as described. 2d, The share, O, provided with the curved bars, j j, in connexion with the shares, M N, and hoe, arranged as set forth.

435. CORN MILLS; J. W. Taylor, Philadelphia, Pennsylvania.

Claim—The application and arrangement of the oblique projections to the shell or concave, operating in the manner specified.

436. TAILORS PRESSING MACHINE; J. W. Thorp, Hillsboro', New Hampshire.

Claim—Raising the heater from the bottom of the hollow goose, either by means of the projections formed on the bottom of the heater, or by adjusting screws, or their equivalents.

437. BEE-HIVES; S. H. Walker, Somerville, Tennessee.

Claim—The moth decoy entrance, provided with the jutting lips or ledges arranged just within the bee entrance across its entire extent, both above and below, in the manner specified. Also, the construction and arrangement of the cross-bars attached to a supporting cross-piece, and with open spaces around their ends, in the manner set forth.

438. BORING MACHINE; John Waugh, Elmira, New York.

Claim—The arrangement of those mechanical appliances in a peculiar manner, substantially as set forth.

439. GAS REGULATORS; D. Wheeler, Fairfield, and Isaac Little, Bridgeport, Connecticut.

Claim—The combination of a self-acting discharge pipe or siphon with the chamber of a gas regulator, as described.

[An inverted siphon is attached to the gas regulator, and arranged relatively to the outlet by which the burners are supplied, and to the other parts of the regulator, that while containing a column of water or other liquid sufficient to balance the pressure of the gas, it will constitute a self-regulating means of escape for any water or liquid matter that may result from condensation in the pipes between the regulator and the burners.]

440. FRICTION SPRING FOR SUPPORTING WINDOW SASH; E. D. Williams, Philadelphia, Pennsylvania.

Claim—Providing with friction springs having sharpened projections or spurs for cutting their own grooves, as set forth.

441. COTTON AND HAY PRESSES; Samson Wolff, Vicksburgh, Mississippi.

Claim—The combination of a conical spiral wheel or pinion with an inclined rack, when the latter is set oblique to the axis of the pinion, in the manner described.

442. MUSQUITO BAR; Thomas S. Williams, Enterprise, Mississippi.

Claim—The folding musquito net or bar, as described.

443. SEATS AND COUCHES FOR RAILROAD CARS; Theodore T. Woodruff, Philadelphia, Pennsylvania.

Claim—The combination and arrangement of the two frames with each other and with the supports therefor, connected with each compartment of a car, the said frame, when spread out, forming couches for two persons, on the same level with the seats; and when transformed one of the said frames forming seats, and the other the back for such seats. Also, connecting the frame which forms the seats with the frame which forms the back, by means of links, connected with one of the said frames by means of hinged joints, and with the other of the said frames by means of sliding hinged joints. Also, in combination with the frame for the main seats, the auxiliary seats which slide under the frame for the main seats. Also, the frame for an elevated couch, when combined with the car, by means of sliding hinged joints. Also, in combination with the elevated couch next to the side of the car, or the equivalent therefor, the front elevated couch, so connected with the car as to admit of being let down to form part of a double couch, and thrown up towards the roof of the car when not wanted as a couch.

444. SELF-ACTING PRESSES; Lester L. Bond, Chicago, Illinois, Assignor to self and Giles B. Williams, City of New York.

Claim—1st. The arrangement for connecting the press beam with the levers by the connecting bars, whereby the press is made to operate from above and below. 2d, The socket shoe and the ratchet plate, or their mechanical equivalents, for altering and ganging the power of the press.

445. MACHINES FOR MAKING UPHOLSTERY SPRINGS; C. A. and S. W. Young, Providence, Rhode Island.

Claim—1st, The cutters, attached to the machine and arranged relatively with the rolls and bar, when the movable cutter is actuated automatically by suitable mechanism to cut the springs as formed from the continuous wire. 2d. The bar, attached to the lever, or other part of the machine or framing, when provided with a bend to project over the uppermost roller, for the purpose of guiding and ensuring the turning or bending of the wire, as set forth. 3d, The plates, when used in connexion with the shears, for the purpose of cutting off the springs and bending the ends thereof simultaneously.

446. MACHINES FOR MEASURING CLOTH; John W. Drummond, Assignor to Horace H. Day, City of New York.

Claim—The combination of the measuring wheel, in combination with the spring block, or the equivalent thereof, for holding the cloth to the periphery of the wheel, and for stopping the said wheel the moment the cloth has passed off.

447. COFFEE POTS; D. G. Fletcher, Assignor to self and Henry Weiskopf, Racine, Wisconsin.

Claim—The box-like strainer arranged with a hinged top, so that access can be had to the same from the inside as well as from the outside, and that the same can easily be cleaned.

448. REFRIGERATOR; Wm. H. Lazelle, Assignor to self and Elbridge B. Lazelle, Boston, Massachusetts.

Claim—The combination and arrangement of the siphon pipe, water space, and ice-box, open and beveled at one end, as set forth.

449. DRY GAS METRES; Hugh Logue, Assignor to self and Daniel P. Vandergrift, Philadelphia, Penna.

Claim—So constructing one of the partitions between two of the chambers of a dry gas metre, that it may afford a passage for the gas from the inlet pipe to the central opening of the valve seat, substantially as set forth.

450. HEMP BRAKE; Henry F. Mann, Assignor to self and Wm. J. Walker, Laporte, Indiana.

Claim—1st. The combination of the adjustable cams or arms with the breaker, as constructed, the whole being arranged as described. 2d, The adjustable spring, as arranged and operated for the purposes set forth.

451. MACHINE FOR CUTTING INDIA RUBBER INTO THREADS; Henry Messer, Roxbury, Assignor to Charles Rice, Boston, Massachusetts.

Claim—The arrangement and combination of the rotating table and the adjustable cutters, as described.

452. GRINDING MILLS; A. Orvis, Niagara, Assignor to self and Downs & Co., Seneca Falls, New York.

Claim—The construction and arrangement of cylinder, D, and concave, F, with supplementary cylinder, G, whereby the rhomboidal teeth, f and g, serve to adjust the parts to efficient action by means of the longitudinal movement of the collar, c, on the shaft, B, substantially as set forth. Also, the peculiar conformation of the grinding surfaces of the cast iron cylinder, E, and concave, H, consisting of the alternate intersection of the raised and depressed corrugations thereof, in the manner described. Also, the combination and arrangement of the two concaves, F and G, spout, j, and divided winged partition, R, or its equivalent, whereby the operation of cracking and grinding in said concaves may be conjoint or separate, substantially in the manner described. Also, the automatic rapper, V, arranged and operated as described, for the purpose of keeping the bolt free from obstructions, and rendering its action efficient.

453. SOFA BEDSTEAD; Wm. H. Tendler, Assignor to self and John F. Moeschlin, Cambridge, Massachusetts.

Claim—The improved sofa bed, constructed not only with each of its arm-rests formed in two parts and hinged together, arranged and applied to the back and bed-frame, but with its seat hinged to the bed-frame, so as to be capable of being moved with respect to it and the arm-rests. Also, the combination of the pillow and foot-rests with the arm-rests and seat frame or seat applied to the frame, the whole being made to operate together essentially as explained.

454. MILL DRIVERS; Ferdinand Walters, Assignor to C. F. Walters and S. H. Stout, Covington, Kentucky.

Claim—The driver, constructed and arranged with reference to the shaft and cap, substantially as set forth.

455. HEEL OF BOOTS AND SHOES; Alfred B. Wilton, Assignor to self and Charles Adams, Dorchester, Mass.

Claim—The improvement of the dished or concave elastic heel, as made with the air channel leading out of the concavity, and arranged as described.

EXTENSIONS.

1. MACHINE FOR GINNING COTTON AND WOOL; Stephen R. Parkhurst, City of New York; patented May 1, 1845; extended May 3, 1859.

Claim—Arranging the metallic rings composing the burring cylinder so near together that no burrs or seeds, &c., can fall in between them, the rings having hooked teeth cut in the periphery, and so placed around the cylinder as not to have the teeth on any two adjoining rings to come opposite to each other, by which the wool or cotton is drawn in below the surface of the rings and the seeds or burrs are cleaned off. Also, the combination of the burring cylinder with the feeding cylinders and trash cylinder, to separate the fibres of cotton or wool from foreign or useless substances.

2. PRINTING PRESSES; Richard M. Hoe, City of New York; patented May 1, 1845; extended May 3, 1859.

Claim—The lifting of the cylinder when it is desired that it should not bear on the form as it revolves, such lifting being effected by means of apparatus connected with the lever, arranged as described. Also, the manner of constructing the spring box or apparatus used by me for checking the momentum of the bed in a cylinder press, but which may be advantageously applied in other machines for a like purpose, said spring box or apparatus being furnished with a centre shaft carrying a toothed wheel that gears into wheels or pinions on several surrounding shafts, the whole of which shafts carry spiral springs, arranged and combined so as to co-operate with each other in the manner described.

3. STOVES; F. L. Hedenberg, City of New York; patented May 7, 1845; extended May 10, 1859.

Claim—The particular manner, as set forth, in which I arrange and combine the flue and air-heating

spaces, and the pedestal of my stove. the hot-air space being between the ascending and descending draft, the descending draft spreading around the base of the stove.

4. The Manufacture of India Rubber Fabrics; Nelson Goodyear, late of Newtown, Connecticut, Henry B. Goodyear, Administrator; patented May 13, 1845; extended May 17, 1859.

Claim—The intermingling and combining fibrous substances with the gum in forming india rubber fabrics, solid and firm in the body, with a smooth surface resembling leather.

Additional Improvements.

1. Journals of Railroad Cars; Wm. Baker, Utica, New York; patented August 11, 1857; additional dated May 3, 1859.

Claim—1st, Placing a cylindrical coiled spring around the piston, immediately above the socket to be used, instead of the volute spring below the piston and within the socket. 2d, I do not claim generally a ball valve, as this is in common use in various connexions, but I claim the use of the ball valve, in combination with the enlarged chamber, and the arrangement described for communicating and sustaining the oil in contact with the journal. 3d, I claim the use of the flat spring to be used for vibrating the piston, together with the arrangement I have described for seating the piston on the spring.

2. Mangles; D. Cumming, Jr., Mobile, Alabama; patented July 27, 1858; additional dated May 3, 1859.

Claim—The employment or use of the cylinder, C, having an elliptical surface upon a portion of its periphery, and having a fixed axis of rotation, the cylinders, D, having a movable axis of rotation, and the eccentric cams arranged upon a movable rod, and their pressure being regulated by suitable springs.

3. Modes of Ventilating Railroad Cars; D. H. Fox and John Fink, Reading, Pennsylvania; patented May 8, 1855; additional dated May 10, 1859.

Claim—As an improvement on our patent aforesaid, the construction of the fan chambers with outlets at each extremity, and their combination with the other portions of the ventilating apparatus.

4. Ore-crushing Machines; Samuel F. Hodge, Detroit, Michigan; patented May 26, 1857; additional dated May 17, 1859.

Claim—The alternate lifting and dropping of a stamper or hammer, by means of the combination of the vertical rod with two or more clamping rollers, the peripheries of which are not complete circles.

5. Cooking Stoves; Samuel B. Spaulding, Brandon, Vermont; patented June 22, 1858; additional dated May 17, 1859.

Claim—The extension of the flues under the hearth, as described.

6. Bow Whiffle-trees; Freedom Monroe, Romeo, Michigan; patented Aug. 26, 1858; additional dated May 24, 1859.

Claim—The bearing bar, the chain and braces attached thereto, and the paddled swivel joint, to be used in combination with my improvement in harness, disclaiming the original invention heretofore patented.

7. Apparatus for Evaporating Saccharine Juices; Lyman P. Harris, Mansfield, Ohio; patented Jan. 18, 1859; additional dated May 31, 1859.

Claim—1st, The application of one or more dampers to the movable furnace; also the cooling surface on the evaporator connected therewith. 2d, The movable flue, as described. 3d, The broad hook or supporter, or its equivalent, as set forth.

Re-Issues.

1. Gas Burners; John R. O'Neil, Kingston, New York, Assignee of Yarnall Bailey, Philadelphia, Penna.; patented October 12, 1858; re-issued May 3, 1859.

Claim—Producing a light which may be increased or diminished at pleasure, by means of the adjustable heater or heat receivers, operating in connexion with a wick tube or holder, and the flame of the lamp or burner.

2. Knitting Machines; Nelson P. Aiken, Troy, New York; patented July 13, 1858; re-issued May 3, 1859.

Claim—Stopping a knitting machine when the yarn accumulates in its needles by the action of the accumulated yarn.

3. Shuttles for Weaving Cloth; James Baldwin, Nashua, New Hampshire; patented January 31, 1840; extended for seven years from and after January 31, 1854; re-issued May 3, 1859.

Claim—Furnishing the shuttle with a spring and catch, so arranged that the bobbin will be received or released at one operation.

4. The Mode of Converting the Backs of Car Seats into Beds or Lounges; Henry B. Myer, Buffalo, New York; patented September 19, 1854; ; re-issued May 3, 1859.

Claim—1st, The use of the backs of car seats for forming upper horizontal beds or lounges. 2d, So arranging the backs of contiguous seats, that they meet and remain in the same horizontal plane. 3d, The use of a cushioned surface intermediate between the cushioned surfaces of two car seats, so as to form with the same a horizontal bed, berth, or lounge. said intermediate cushion forming an attachment to, and appearing as part of, the car seat, when not adjusted to aid in forming a berth, bed, or lounge. 4th, Forming a continuous line of lower horizontal beds, berths, or lounges, of a series of car seats in railroad cars, by uniting the several seats so as to fill up the entire space between the seats with adjustable cushioned attachments of the seats, whatever be the character or disposition of said attachments, so long as they form and appear as parts of the seats, when not adjusted to form said continuous line of lower beds, berths, or lounges.

5. Retorts for Distilling Oils from Coal; John Nicholson, Alleghany, Pennsylvania; patented February 15, 1859; re-issued May 3, 1859.

Claim—1st, The use of a straight or curved, or straight blade or blades placed on the agitators or arms of shaft, for the purpose of agitating, lifting, mixing, and bringing all parts of the mass within the retort in contact with the heat. 2d, The arrangement near the outer edge of one end of a retort, of four or more supply and discharge openings, and on the other end near the outer edge of four or more exit pipes placed on a line with, and opposite to, the supply and discharge openings.

6. Coffee Pots; Wm. H. Elliot, Plattsburg, New York; patented January 25, 1859; re-issued May 10, 1859.

Claim—1st, The combination of boiler, still-worm condenser, conducting plate, and the external opening

of the still-worm at g′, when these devices are so arranged in relation to each other that an opening to the external air shall be provided for the non-condensible gases, while the condensible vapors are reduced to a liquid without coming in contact with the condenser water, and then turned by conductors into the boiler. 2d, The arrangement of the joint below the spout, so that vapor can pass through the spout without first passing the joint. 3d, The employment of conductors, in combination with the condenser, for the purpose of filling the water joint or keeping it full.

7. Mowing and Reaping Machines; J. W. Mulley, Amsterdam, New York; patented Dec. 16, 1856; re-issued May 10, 1859.

Claim—1st, Connecting the frame of the platform with the frame carrying the driver and raker's seat, in the manner set forth, namely, securing the relative position of the two frames by means of the brace in the rear, and the laterally inclined draw-shoe in front. 2d, The shoe, in combination with the tongue attachment in front thereof, the said shoe being constructed and arranged as described. 3d, The rod and the rails, connected in the manner described, in combination with the pole, the rocking shaft, and the lever. 4th, The arrangement in relation to the driver's seat of the lever and mechanism connected therewith, for raising and lowering the cutter bar, whereby the sickle may be raised in the manner described.

8. Grain Separators; John R. Moffitt, Piqua, Ohio; patented Nov. 30, 1852; re-issued March 23, 1858; re-re-issued May 17, 1859.

Claim—The endless chains, composed of metallic links provided with protuberances or depressions, when used in combination with suitable driving chain gears to impart a positive motion to the straw-carrier of a threshing and separating machine.

9. Grain Separators; John R. Moffitt, Piqua, Ohio; patented Nov. 30, 1852; re-issued March 23, 1858; re-re-issued May 17, 1859.

Claim—In combination with a receptacle in which the tailings are deposited by the winnowing apparatus, the arrangement of the screw elevator in relation to the threshing cylinder, for the purpose of returning the tailings to be re-threshed.

10. Grain Separators; John R. Moffitt, Piqua, Ohio; patented Nov. 30, 1852; re-issued March 23, 1858; re-re-issued May 17, 1859.

Claim—The reversible screen and delivery spout, arranged with, and to the discharging spout of, the "fanning mill" or "shoe" of a threshing machine, so as to be isolated from the winnowing arrangement, and made to deliver at either one side or the other of the machine.

11. Grain Separators: John R. Moffitt, Piqua, Ohio; patented Dec. 1, 1857; re-issued May 17, 1859.

Claim—The arrangement of disconnected shafts, carrying pinion chain gears, rotated at equal speeds from a single shaft or driver, and acting to drive the endless apron from its lower end, while permitting the escape of the straw through the lower openings of the apron.

12. Machinery for Preparing Oval Picture Frames; Wm. Gardner, City of New York; patented August 17, 1858; re-issued March 15, 1859; re-re-issued May 17, 1859.

Claim—The combination of a scraper adapted to the form of the moulding, with the revolving face-plate of a lathe, when the said scraper is so arranged as to be self-adjusting laterally to the said moulding.

13. Grain Separators; John R. Moffitt, Piqua, Ohio; patented Dec. 1, 1857; re-issued May 17, 1859.

Claim—The construction and arrangement of the rotary beater within the apron, in combination with the falling sections.

14. Grain and Grass Harvesters; C. Aultman & Co., Canton, Ohio, Assignees of Philo Sylla and Augustus Adams, Elgin, Illinois; patented September 20, 1853; re-issued May 17, 1859.

Claim—1st, An elevated binding table, in combination with the platform for receiving the grain as it is cut. 2d, The combination with the binding table of one or more binders' stands on a lower level than that of the table. 3d, The combination of a binding table with a binders' stand, having an elevated side for the binder to rest his legs against, and thereby steady himself without the aid of his arms, both of which are thus left at liberty to do the binding. 4th, The arrangement of the rakers' and binders' stands, so that the grain may be raked from the platform, and delivered upon the binders' table before the several binders' stands. 5th, The arrangement of the dumping-tray with the rakers' and binders' stands.

15. Grain and Grass Harvesters; C. Aultman & Co., Canton, Ohio, Assignees of Philo Sylla and Augustus Adams, Elgin, Illinois; patented September 20, 1853; re-issued May 17, 1859.

Claim—1st, The combination of the finger beam and the main frame with a yielding coupling arm, whereby the progressive movement of the finger beam over the ground will be controlled by the main frame, and its upward and downward movements by the undulations of the ground over which it is drawn. 2d, The combination of a yielding coupling arm and a yielding brace bar with the finger beam and main frame. 3d, The combination of the yielding bars and the removable bolts, or the equivalent thereof, with the finger beam and main frame, whereby the finger beam may be allowed to slide loosely on the ground to adapt the machine to mowing, or be held firmly above the ground to adapt the machine to reaping.

16. Grain and Grass Harvesters; C. Aultman & Co., Canton, Ohio, Assignees of Philo Sylla and Augustus Adams, Elgin, Illinois; patented September 20, 1853; re-issued May 17, 1859.

Claim—The short finger beam, in combination with the yielding connexion with the main frame, or its equivalent.

17. Grain and Grass Harvesters; C. Aultman & Co., Canton, Ohio, Assignees of Philo Sylla and Augustus Adams, Elgin, Illinois; patented September 20, 1853; re-issued May 17, 1859.

Claim—The combination of the finger beam with the hinges by which it is drawn, arranged above the plane of the cutter.

18. Grain and Grass Harvesters; C. Aultman & Co., Canton, Ohio, Assignees of Philo Sylla and Augustus Adams, Elgin, Illinois; patented September 20, 1853; re-issued May 17, 1859.

Claim—The combination of a counterpoise weight, or the equivalent thereof, with that end of the finger beam next the main frame, to equalize its pressure upon the ground. Also, the combination of a counterpoise weight, or the equivalent thereof, with each or either end of the finger beam, to diminish its pressure upon the ground.

19. Grain and Grass Harvesters; C. Aultman & Co., Canton, Ohio, Assignees of Philo Sylla and Augustus Adams, Elgin, Illinois; patented September 20, 1853; re-issued May 17, 1859.

Claim—The combination of a stop with the mechanism for connecting the finger beam with the main frame, and allowing it to rise and fall.

20. MANUFACTURE OF INDIA RUBBER GOODS BY MEANS OF ZINC COMPOUNDS; Horace H. Day, City of New York, Assignee of Henry G. Tyer and George Helm, New Brunswick, New Jersey; patented Jan. 30, 1849; re-issued August 7, 1849; re-re-issued May 24, 1859.

Claim—India rubber fabrics made by the combination of caoutchouc, in its several varieties, with the sulphuret of zinc, or the bi-sulphuret of zinc, or the hyposulphite of zinc, or the sulphite of zinc, and also with zinc compounds in their several forms, as set forth, and sulphur, and in combination with these in either case, the submitting said compound to the action of steam at a high temperature, the whole being combined and manufactured substantially as described.

21. APPARATUS FOR RAISING WATER; Wm. T. Barnes, Buffalo, New York; patented March 20, 1849; re-issued May 24, 1859.

Claim—1st, The combination of a casing whose sides slope outward from the induction opening with a revolving piston, the edge of whose blades conform to, and run near to, the sloping sides of the casing or the spiral rib. 2d, In combination with a casing whose sides slope outward from the induction openings. I claim a rotating piston, with fixed blades, inclined upon the face to the axis of the piston rod. 3d, Dividing the stream of liquid as it enters the casing containing the rotating piston, by causing it to pass through two or more induction openings, arranged so that the blades of the piston pass over these openings.

22. INKSTANDS; Thomas Robjohn, City of New York; patented August 25, 1857; re-issued May 24, 1859.

Claim—1st, The arrangement for flexing the elastic diaphragm, by attaching a mechanism in connexion with the cover for the ink cup, that the opening and closing thereof shall effect the raising or discharge of the ink, or other fluid, into or from said cup. 2d, The cover, arranged and operating as above set forth, in combination with the elastic or flexible diaphragm and a non-corrosive fountain or ink cup, when operating as specified. 3d, The combination and arrangement of cam lever and plunger, or the equivalents thereof, for effecting the raising or discharge of the ink by raising or closing the cover of the non-corrosive fountain cup. 4th, Arranging the cam centres in such relation to each other that, by raising the cover, the requisite depression of the diaphragm will be produced to obtain the required result.

23. CRACKER MACHINE; John McCollum, City of New York; patented March 23, 1852; re-issued May 31, 1859.

Claim—The combination of adjustable springs with a cracker cutter and its resisting surface or bed.

24. MACHINE FOR CREASING AND BLACKING LEATHER FOR HARNESS; Adolph Stempel, City of New York; patented Nov. 2, 1858; re-issued May 31, 1859.

Claim—1st, The pressure roller and the creasing and embossing rollers, in combination with the color fountains and felt rolls, arranged to operate as set forth. 2d, The arrangement of the embossing rollers with their projection flanches, to operate in combination with the guides, in the manner specified.

25. PLATES FOR BOILER HOLES AND TOPS OF STOVES; David Stuart and Richard Peterson, Philadelphia, Penna., Assignees (through mesne-assignment) of John B. Chollar, Albany, New York; patented February 6, 1849; re-issued May 31, 1859.

Claim—Constructing a cross-piece for cooking stoves and ranges with a hollow chamber, and with the openings to allow air to pass into the said chamber, as set forth.

26. GRINDING AND POLISHING KNIVES; James Dodge, Waterford, Assignor to self and David Blake, Albany, New York; patented October 12, 1858; re-issued May 31, 1859.

Claim—Grinding and polishing articles, and forming their surfaces upon or against the periphery of a grindstone or polishing wheel, or other analogous reducing surface, by attaching them to the periphery of a revolving drum or cylinder. Also, making matrices in the periphery of a wheel to which a series of articles to be ground are attached, said matrices being adapted to give the required shape to the articles to be ground, so as to grind, polish, and shape such articles in a uniform manner. Also, in combination with said matrices, attaching and supporting the articles to be ground upon the cylinder, in such manner as to allow them to rock or accommodate themselves thereon, whereby their surfaces may be shaped either convex, flat, or concave.

27. GAS LAMPS; George H. Bechtel, Assignee (through mesne-assignment) of Horatio G. Sickles, Philadelphia, Pennsylvania; patented August 7, 1849; re-issued May 31, 1859.

Claim—1st, Forming a valve within the adjustable gas chamber, and a seat for the said valve on the tube which contains the wick, so as to regulate and extinguish the light when required, whether the said valve be made and arranged in the manner described, or other means substantially the same, by which similar results may be produced. 2d, The employment of the safety valve, in combination with the guard, constructed substantially as described. 3d, The guard, in combination with the combined burner and generator, arranged in the manner set forth. 4th, Combining the generator, burner, ring, and guard, in a single piece, made to ascend and descend simultaneously, in the manner set forth.

DESIGNS.

1. BURIAL CASE; John McMurthry, Assessor to George C. Murthry, Fayette, New York; dated May 3, 1859.
2. SPOON AND FORK HANDLES; Wm. H. Lewis, Glastenbury, Connecticut; dated May 3, 1859.
3. STOVES; Sherman S. Jewitt and Francis H. Root, Buffalo, New York; dated May 3, 1859.
4. WATCH GUARDS; George Blanchard, City of New York; dated May 10, 1859.
5. STOVE PLATE; J. W. Lane, Newton, New Jersey; dated May 10, 1859.
6. STOVES; David Hathaway, Assignor to Fuller, Warren & Co., Troy, New York; dated May 17, 1859.
7. SEPULCHRAL MONUMENTS; Richard Barry, Boston, Massachusetts; dated May 24, 1859.

JUNE 7.

1. PRINTING OIL CLOTHS; James Albro, Elizabeth, New Jersey.

Claim—Forming ornamental figured surfaces on oil cloth, by raising parallel ridges or surfaces, b, on the ground color, when in a soft or green state, by means of a properly prepared block pressed upon it; and then forming parallel ridges or raised surfaces, d, at right-angles thereto, and in the form of the design or desired configuration, by means of a properly prepared block. It being understood that I claim the privilege of having either the ground, b, or figure, d, one of them only, if desired, composed of dots or broken lines or ridges, in order to obtain a similar effect.

2. Breakwater; D. Hillen Armour, Columbia, Texas.

Claim—The projecting or overhanging sand plate, applied in combination with the diagonal walls of the breakwater, as described.

[This breakwater is designed to protect a channel across a bar from the flow of sand which comes in upon the bar with each tide, and thus keep the channel open without the necessity of making the channel in the bar narrower than the channel in the river. This will, of course, give accommodation to more ships entering a river with a tide, and will ensure a course for ships even at low water.]

3. Washing Machine; D. S. Ayres, Hope, New Jersey.

Claim—The revolving discs or heads with the mode of operating the same, as applied to washing machines.

4. Device for Raising Water; J. A. Ayres, Hartford, Connecticut.

Claim—The wind-wheel, vane, endless chain, with buckets and weight attached, the cylinder and annular receiving trough, arranged for joint operation substantially as set forth.

5. Revolving Fire Arms; Thomas Bailey, New Orleans, Louisiana; patented in England, Jan. 17, 1859.

Claim—1st, The placing of the within named working or actuating means within the body, as set forth. 2d, The revolving chamber working on two adjustable centres of suspension instead of in the ordinary way. 3d, The mode described of connecting the barrel to the body. 4th. The stopping or retaining of the revolving chamber by means of a spring stop acting on the ratchet, such stop being actuated by a cam on the tumbler. 5th, The notch or cavity in the cap guard or cock-nose, to fit upon the solid part of the chamber, and retain the chamber in a safe position.

6. Bridle Bits; J. B. Baker, Syracuse, New York.

Claim—The attachment, as described, of sliding rings or rein connexions to the curb bars of bridle bits, when the same are operated upon by springs attached to the bit, in the manner set forth.

7. Chimney Cowl; Henry Bedlow, Newport, Rhode Island.

Claim—The arrangement and combination of the chimney top or tube, a, chamber, f, tubes, g, or other external draft passages and deflectors, the tube chamber and draft passages communicating with each other and the external air, to operate as set forth.

8. Method of Sawing Shingles from the Bolt; N. Boardman, Fond du Lac, Wisconsin.

Claim—1st, The employment or use of two bolt carriages, when used in connexion with the adjustable planes, and arranged in the relation with the circular saw, as shown, so that a shingle may be sawed from each bolt at each movement of its carriage, and the two bolts operated upon simultaneously by means of one and the same law. 2d, The adjustable or tilting tracks or bolt frames, in combination with the reciprocating carriages and saw, arranged to operate as set forth.

9. Enamel Compositions for Bricks, &c ; Decius W. Clark, Bennington, Vermont.

Claim—The enamel or glaze for pottery ware, or other articles formed of the ingredients, and substantially as specified.

10. Improvement in Tanning; Jehu Brainard and W. H. Burridge, Cleveland, Ohio.

Claim—The described process of treating skins or hides in a preparation of liquor or liquors, as described.

11. Pocket-handle for Billiard Tables; John M. Brunswick, Cincinnati, Ohio.

Claim—The pocket-handles, arranged and secured as described, and formed of vulcanized gutta-percha or india rubber.

12. Machines for Burring Wool and Ginning Cotton; F. A. Calvert and C. G. Sargent, Lowell, Mass.

Claim—A cylinder having spaces between the teeth for the accommodation of the seed, in combination with a revolving guard, operating in the manner described.

13. Corn Huskers; J. C. Clapp, Seneca Falls, New York.

Claim—The combination and arrangement of the carriage, fly-clearer, cross lever, concaves, and gauge, blade, and tread lever, operating conjointly as set forth.

14. Method of Jointing Shingles; S. C. Coffin, Lawrenceville, Pennsylvania.

Claim—So combining with the horizontal saw that saws the shingle from the bolt, the transverse piece, and carriage upon it, so that the same saw that cuts the shingles from the bolt may be used for joining said shingles.

15. Knitting Machines: Enoch Colvin, Poultney, Vermont.

Claim—1st, The combination of the needle arm and the iron rim upon the ring, constructed for raising each needle by itself, and completing each stitch before another is begun. 2d, The cylinder for reversing and regulating the motion of the machine while forming the heel and toe. 3d, The combination of the notched wheel, t, the toothed bar with its pointer, the cylinder, the elevating arm, the elevating bar and cam thereon, and the pin on the wheel, by means of all which the motion of the machine is reversed back and forth, and regulated so as to knit upon a straight hose flaps of the proper form for the heel and toe. 4th, The wheel, p, and the elevating arm, combined with the several parts and devices mentioned in the last preceding claim or paragraph, as above described, for setting in motion at the proper juncture the machinery for regulating the formation of the flaps for the heel and toe.

16. Light Shade for Billiard Table; David Conlan, City of New York.

Claim—A shade for billiard tables, &c., having two reflecting parts, and otherwise made as described.

17. Rakes; Thomas Crane, Fort Atkinson, Wisconsin.

Claim—My improved harvesting rakes for gathering and elevating cut stalks of grain preparatory to binding the same into sheaves, when the said rake is composed of side handles, gathering fingers, and swinging legs, or the equivalents of the same, as set forth.

18. Lock; Thomas Dougherty, Macon, Georgia.

Claim—The employment of the spring tumblers, when constructed and operated in the manner described, in connexion with the bolt, the said springs being detained by the key to let the bolt slide.

19. Chain Pump; Daniel Du Pré, Raleigh, North Carolina.

Claim—1st, The endless chain for raising water, composed of the curved detachable links, when said links are constructed and united in the manner set forth. 2d, Keeping the chain stiff between the upper and lower

pulleys, by means of projections on the links. 3d, The combination of the curved links with the peculiarly shaped curved buckets, when constructed in the manner set forth.

20. RAILROAD CHAIRS; Wm. B. Dunning, Geneva, New York.

Claim—1st, The peculiar form of a partly raised and double-slotted bed-plate. 2d, The peculiar form and position of the clamps, one part of them being confined and borne down on the tie by the weight of the rail and all above it, and the other part, viz: the jaw, resting upon the flanch of the rail and holding it fast. 3d, The combination of the several parts, as described, or their mechanical equivalent.

21. HYDRANTS; James Fay, Baltimore, Maryland.

Claim—The arrangement of the stock and chamber, as constructed with the india rubber ball, rod, opening in the top of box, nut, spring, valve stem, valve, and thimble, the several parts being used and operating conjointly, in the manner specified.

22. HORSE POWER MACHINES; Wm. Field, Providence, Rhode Island.

Claim—Arranging and supporting a hollow driving shaft, and the driven shaft passing through the driver, whereby both driver and driven shaft turn in the same direction, and both ends of the driver are fully supported by boxes independent of the shaft passing through it, while at the same time the bearing of the shaft passing through the hollow driver will be on the driver only at a point directly opposite its journal, so that any slight displacement of either shaft will not cause them to bind on each other so as to increase the friction of the machine.

23. MACHINE FOR OPENING OLD ROPE; Archibald Ford, Newport, Kentucky.

Claim—The elevated bar provided with cavities, arranged in the described relation to the feed mechanism and drum, and operating in combination with the latter, to preparatorily open the butts of the rope.

24. MODE OF STARTING CITY RAILROAD CARS; George P. Frick, Baltimore, Maryland.

Claim—The application of a lever acting temporarily upon the axle of a railway carriage, or other wheeled vehicle, in combination with the pulley and chain, and whether the pulley is of uniform or different diameters, as described. Also, such lever, in combination with the ratchet wheel and catch, in their application to railway or other wheeled vehicles. Also, the cord, whereby the lever may be loosened from the catch at the will of the driver, in combination with the said lever, and catch pulley, and chain, when applied to a railway carriage, or other wheeled vehicles. Also, the combination of the catch and ratchet wheel with the chain and weight, described in the foregoing specification, whereby the engaging and disengaging of the catch is operated by the motion of the draft bar.

25. LEGS FOR PIANOS; Felix and Charles Gelin, City of New York.

Claim—The glass socket, so mounted in the legs of musical instruments, that the escape of sound from the instrument to the floor is checked, without injuring the appearance or endangering the strength or durability of the instrument.

26. MONEY BOXES FOR STAGES, &c.; T. W. Gibbons, Franklin, New Jersey.

Claim—1st, The box provided with the drawers, the former having a flap or door in its bottom, and arranged to operate as set forth. 2d, The change slide or plate, one or more, used in connexion with tubes, and arranged relatively with drawer to operate as set forth. 3d, In combination with the drawers and change plate or plates, the bell and index, and dial, arranged as set forth.

27. SAFETY CAGE FOR COAL SHAFTS; D. Glover, Township of Cass, Schuylkill Co., Pennsylvania.

Claim—The construction of the cage in two separate sections, separated at the guides, and so connected by hinges at the top of the bottom of the sill that, when the rope or chain used in hoisting breaks, or the power ceases to operate, the cage shall open at the top where the sections are joined, and the height and weight of each section shall operate as a lever and weight to force the iron shoe on the ends of the sills and pieces powerfully against and into the guides, and by this means entirely prevent the dropping of the cage and car down the shaft.

28. CLEANING SPINNING MULE CARRIAGE TOPS; Robert Greaves, Philadelphia, Pennsylvania.

Claim—The described mode of cleaning mule carrisge tops, or any mechanical equivalent thereto.

29. WIND WHEELS; W. L. Gregory, Theresa, New York.

Claim—The arrangement of the main vane and the regulating vane, to operate in combination with the wings, as described.

30. ROCKING CARRIAGE; Albert C. Griswold, Hartford, and Walter R. Griswold, Durham, Connecticut.

Claim—The employment of the rockers, in combination with the seats or cribs. Also, the railway track or frame work with the cords or rods and springs, when used as described. Also, the employment of the elastic substance attached to the rocker, for the purpose described.

31. PADDLE-WHEEL; John W. Harris, Durhamville, New York.

Claim—Constructing paddle-wheels for boats in such a manner that the paddles may be folded laterally upon the frame, and the wheel thereby withdrawn from projecting beyond the sides of the boat, or extended at pleasure, whether the boat be in motion or at rest, the paddles being connected to the frame work, and their outer edges of the form shown.

32. ROTATING DUMPING CAR; Wm. A. Hawkes, Corinth, New York.

Claim—The arrangement and combination of the rotating platform, provided with dumping boxes, with the shaft and gearing, and the clutches, as described, so that the car may be propelled, and the dumping boxes rotated by turning shaft, as desired.

33. MATTRESS; Henry W. Henley, City of New York.

Claim—The use or employment of the serrated section, when the same shall be combined for the purpose specified.

34. HARROWS; J. Herald and C. B. Tompkins, Trumansburg, New York.

Claim—The arrangement of the plates with recesses and projections, and with a hole in their centre, for the purpose of securing the bars and the tooth, in the manner specified.

35. MACHINE FOR MOVING IRON AT THE ROLLS; Charles Hewitt, Trenton, New Jersey.

Claim—The movable floors, platforms, or supports, for moving iron or other metal at the rolls while in process of manufacture, constructed as described, or otherwise substantially the same.

36. Machine for Working Butter; Gideon Hotchkiss, Windsor, New York.

Claim—The combination of the lever stern ladle and oblong bowl, by means of the revolving joint, the projecting cope, and follower ladle, as described.

37. Loom Temples; Wm. H. Howard, Philadelphia, Pennsylvania.

Claim—The rollers twining in bearing or steps, arranged to yield independently of, and in contrary directions to, each other, on the opening of the warp threads, as set forth.

38. Construction of Prisons; Enoch Jacobs, Cincinnati, Ohio.

Claim—A secret passage or guard chamber around the outside of an iron plate jail, and between said jail and a surrounding enclosure, constructed and arranged as described.

39. Manufacturing Knitted Fabrics; Joseph K. Kilbourn, Pittsfield, Massachusetts, and Edward E. Kilbourn, Litchfield, Connecticut.

Claim—The new knitted fabric described, composed of columns of stitches oblique to each other, having openings at the places where the oblique columns of stitches diverge.

40. Saw Filing Machine; T. E. King, West Andover, Ohio.

Claim—The suspending the file-holder upon arms, so that it is susceptible of adjustment horizontally, vertically, and obliquely, and in combination with the curved faced slot in the holder.

41. Machine for Sawing Circular Bevels; John Lemman, Cincinnati, Ohio.

Claim—The adjustable rest hinged to the bed, in the manner described, and adjustable vertically with reference thereto.

42. Bung Cutter; Josiah Kirby, Cincinnati, Ohio.

Claim—The mode of pointing the lower or last end cut of the plug or bung by forcing it into a separate dog, made and used substantially as described. Also, the mode of lifting the plug out of the dog, after it has been compressed, by means of rod, G′, when operated in the manner described. Also, the mode of driving the plug out of the cutter into the compressing dog by movable rod, when operating in the manner described.

43. Adjustable Hammer for Revolving Fire Arms; Alex. Le Mat, New Orleans, Louisiana.

Claim—Providing the hammer with a hinged head, so arranged that it shall present the same face in different directions, for the purpose of discharging, in succession, different barrels, or a grape shot pistol and a revolving fire arm, as may be desired, and providing the same with small lateral wings for locking the revolving chambers in position, in the manner set forth.

44. Automatic Finger for Closing the Vent of Cannons, &c.; Alex. Le Mat, New Orleans, Louisiana.

Claim—1st, The apparatus with automatic finger, substantially as described. 2d, The inclined plane, in the manner and purpose described, or as an equivalent, the inclination of the slot of the percussion lock, for the purpose set forth.

45. Compound Railroad Axles; H. J. Lombaert, Philadelphia, Pennsylvania.

Claim—The divided tubular axle and the solid undivided centre piece or mandrel, when the same are constructed and combined together, with each other and with the wheels, so that the said two tubular parts shall project through their respective wheels and form their journals, and also rotate out of contact and independently of each other.

46. Furnace Grate Bars; Warren S. Low, Albany, New York.

Claim—The combination of the corrugated and circular removable face piece with the body of a furnace grate bar, in the manner set forth.

47. Shoe Sole; Wm. J. Lyman, East Hampton, Massachusetts.

Claim—The use, or application, or employment of metallic in-soles to shoes, boots, &c.

48. Harvesting Machines; H. H. Luther, Warren, Rhode Island.

Claim—1st, Attaching the finger bar, P, to the frame, J, suspended on the shaft, K, and fitted between bars, J J, on frame, O, and arranged on shaft, B, so that the finger bar, D, and sickles may, when necessary, be elevated, and placed directly over the main wheel and shaft. 2d, Adjusting the finger bar, P, and sickles, in a more or less inclined position, in order to cut the grass or grain the desired height, by having the finger bar attached to a circular frame, G, fitted on the arm of the driving wheel, and secured at the desired point by means of the lever and projections, or any equivalent fastening. 3d, The arrangement and combination of the frames, J G, applied to the driving wheel in connexion with the gearing, respectively on the wheel, F, shafts, t t, and in the frame, J.

49. Burnishing Mouldings; Robert Marcher, City of New York.

Claim—Attaching a self-adjusting burnisher to a reciprocating plate or carriage, when used in connexion with a moulding suspended and attached to the machine in the manner as shown, or in any equivalent way, to admit of being acted upon by the burnisher.

50. Machines for Finishing Bricks; W. S. Mayo, City of New York.

Claim—The combination of the box, plunger, and plates, with or without the feed block, substantially as set forth.

51. Manufacture of India Rubber Blankets or Aprons used in the Printing of Fabrics, Books, &c.; Charles McBurney, Boston, Massachusetts.

Claim—Bringing the blanket to a uniform thickness and smooth surface, by passing it between a revolving emery roll and a revolving feed roll, so arranged with respect to each other that the surface of the feed roll shall be ground by the emery wheel, as set forth.

52. Rotary Harrows; J. W. McLean, Lebanon, Indiana.

Claim—The combination of the specified obliquely set teeth, with two or more harrow frames revolving in opposite directions, as set forth.

53. Sewing Machines; James S. Moody, Cincinnati, Ohio.

Claim—The employment of an endless belt, arranged and operated as described, to carry one or more hooks to draw the thread through the cloth. Also, the tension collar, embracing the thread and needle, and operating to hold the thread, in the manner set forth. Also, alternately holding and releasing the double pointed needle by means of sliding keys, operating so as to pass through notches towards the ends of said needle at the proper times, arranged in the manner set forth.

54. Truss for Bridges, Roofs, &c.; Samuel J. Reeves, Philadelphia, Pennsylvania, and Montgomery C. Meigs, Washington City, D. C.

Claim—The mode of trussing or stiffening a curved or arched beam or rafter for bridges or roofs, by means of tension rods or ties of metal, wood, or other suitable material, connected at their outer ends with the arched or curved beam or rafter at various points, and converging towards, and connected together at, their inner ends at a point within the space contained between the arc or arched or curved beam or rafter, and the straight line joining its extremities, substantially as described.

55. Apparatus for Drying Glue; M. Newbauer and P. Adelman, City of New York.

Claim—The arrangement of a chamber of circular or polygonal form, which is provided with a fan blower, or its equivalent, to which air of the proper temperature is conducted by means of a pipe and tube, for the purpose of drying the cakes of glue.

56. Steam Boilers; Wm. Oldman, Buffalo, New York.

Claim—The central water space in the combustion chamber, arranged in relation to the annular water space, and to the tubes, or their respective equivalents, for the purpose of inducing an active circulation of the water radially among the tubes, with the advantages explained.

57. Apparatus for Exhibiting Stereoscopic Pictures; Stuart Perry, Newport, New York.

Claim—1st, A movable frame work for holding a series of stereoscopic pictures, from which the pictures are brought to be inspected, and then returned to it again by a mechanism operated by the user. 2d, Bringing each individual picture or pair of pictures, in succession, to the same point or place, before they are projected from their compartments to be exhibited, by mechanism. 3d, In combination with a movable picture-holder, a reciprocating carrying frame, that catches each picture or pair of pictures, in succession, and carries them to the place where they are to be inspected, and returns them to their compartment again. 4th, In combination with a box or case containing within it a series of pictures and a mechanism for projecting them from said case, a frame work on the outside of said box or case for receiving said picture. 5th, The slots in the picture-holder barrier and in the box or case, so that the picture, from its compartments in the picture-holder, may be projected through both slots or openings to the outside of the box. 6th, The friction brake, or its equivalent, for holding the picture-holder and prevent it from moving until started by the crank. 7th, Making the frame in sections or with an opening, for the purpose of introducing the pictures through said frame into the compartments of the picture-holder as well as removing them therefrom. 8th, The clamps, as applied to single or double pictures, for the purpose of strengthening them, preventing their warping or bending, and thus facilitating their passage through the slot, which they must pass through, to the place where they are exhibited.

58. Machinery for Drying Paper; Edward L. Perkins, Roxbury, Massachusetts.

Claim—Feeding the paper from a roll outside of the drying chamber, through proper openings, to a series of rollers, and then conducting it over said rollers vertically through the apparatus, and subjecting it, during its passage, to a gentle current of heated air, produced by forming inlets at the bottom for the reception of the atmospheric air, which passes up and is heated by a suitable heating apparatus, and escapes readily through apertures at the top, and then out of the drying chamber through proper openings to a receiving roller.

59. Tail Pieces for Violins; John Pfaff, Philadelphia, Pennsylvania.

Claim—The metal tail pieces with an eye adapted to the detachable pin, recesses for the reception of the strings, and with the rib, as set forth.

60. Cutting Out Strap Hinges; Samuel M. Richardson, City of New York.

Claim—The relieving die, in combination with the shaping die and cutter, in the manner specified.

61. Dust-pan; J. Hall Rohrman, Philadelphia, Pennsylvania.

Claim—A dust-pan, having its bottom corrugated and its back edge seamed over, for the purposes of making the bottom of the pan rigid without extending any brace from the handle, and rendering unnecessary the wiring of the back edge of the pan.

62. Furnaces and Stoves; Charles B. Sawyer, Fitchburg, Massachusetts.

Claim—1st, The arrangement of the closed-topped fire-pots, gas or combustion chamber, fire or draft flues, small gas openings, and air heating flues, in relation to each other. 2d, The arrangement of the horizontal ventilating flue, ventilating chamber, and exit ventilating flue, and right-angled draft flue, in relation to each other and in the top of the furnace.

63. Spring Bedstead Bottoms; George Schott and John Loudon, City of New York.

Claim—The arrangement of the eyes, elastic cord or strap, and hooks, on the ends of the slats. Also, the studs, constructed and acting to sustain the slats on the strap or elastic cord.

64. Grinding Mills; Joseph Sedgebeer, Cincinnati, Ohio.

Claim—1st, Constructing the rotating plate with the same dress or finish upon its grinding face as that of the stationary plate. 2d, The diamond-shaped teeth, arranged as set forth.

65. Means of Securing the Bits of Bench Planes; Charles W. Seely and Benjamin F. Locke, Wellington, Ohio.

Claim—Stopping the upper end of the interposed bit below the screw, and upsetting it so as to catch into the cross serrations in the bed-piece.

66. Mode of Switching Off Railroad Cars from one Track to another; M. Semple, Philadelphia, Pa.

Claim—The immovable switch or turnout, in combination with the guide bars, when arranged as described.

67. Machine for Raising Water; Peter Shank, Jefferson Township, Ohio.

Claim—The combination of the horizontal float wheel, the crank motion (as produced by the three pins) which gives six motions of the pump to one revolution of the wheel, and the horizontal double pump.

68. Operating Machinery by Dog Power; Dexter C. Slater, Lawrence, New York.

Claim—The arrangement and combination of the wheel, shaft, cam, and lever, as set forth.

69. Cheese-cutters; De Witt Stevens, Newark, New Jersey.

Claim—1st, The arrangement of the platform with the projecting rings, to operate in combination with the corrugated cutting edge of the knife. 2d, The arc, arranged in combination with the platform, with the handle, and with the knife, so that the cheese on the platform can be cut up in slices of any given

weight. 3d, The arrangement and combination of the lever, the link, and the slide, for the purpose of operating the knife.

70. Rocking Cradle; W. D. Tewksbury, Cuylersville, New York.

Claim—The two escapement wheels, arranged in combination with the verge and with the arm, in the manner described.

71. Method of Printing Bank Notes; Alfred Tichenor, Newark, New Jersey.

Claim—1st, The making bank notes, and other engraved plates or sections of plates, with tongue and groove or dowel joints. 2d, The locking together tongue and grooved bank note or other engraved plates, by a chase, having it formed with tongue or groove, or with dowels made to match or correspond to the ends and sides of the tongue and grooved plate, which chase is made in pieces, fitted together and furnished with set-screws, as described.

72. Bee-hives; Ruggles S. Torrey, Bangor, Maine.

Claim—Providing the troughs in the tops of the comb-bars, arranged with the series of conducting tubes for conveying the feed to the troughs, and with apertures or slots for the free exit of the moisture to the condenser.

73. Brick Machine; William S. Watson, Madison, Indiana.

Claim—1st, The combination and arrangement with a stationary pressing block of an intermittently reciprocating press-box, formed with one or more chambers, and provided with one or more plungers, having a joint motion with the press-box, and an independent movement thereto. 2d, The combination with the intermittently reciprocating press-box, of the top and bottom holding slides, or either of them, arranged to move conjointly with the press-box, and independently of it. 3d, Mounting the intermittently reciprocating press-box with a feed-box, having one or more chambers.

74. Machine for Finishing Leather; T. F. Weston, Salem, Massachusetts.

Claim—1st, The combination and arrangement of the devices herein described, or their mechanical equivalents, for changing the angle of the tool while the machine is in motion, so as to cause it to operate upon the latter. first with a sharp edge, to take out its inequalities, and then with a dull or blunt edge, to smooth the leather, the successive operations producing the peculiar effect desired. 2d, The arrangement of devices herein described. for giving positive motions to the tool, for lifting it from, and holding it down upon, the bed, the same consisting of the sliding bar and friction box.

75. Omnibus Register; Robert F. White, City of New York.

Claim—The spring platform, arranged in combination with the hammer, and with the index, and operated by the lever, or its equivalent, in the manner specified.

76. Lock Attachment; John M. Wilson, Philadelphia, Pennsylvania.

Claim—The arrangement, in combination with a lock and door of the box, key-holes, wards, guard, plate, pivoted stops, and springs, arranged in the manner set forth.

77. Washing Machine; Samuel Wiswall, Hyde Park, Vermont.

Claim—The arrangement and combination, within the oscillating cylinder of a receiving chamber, having plates and a door, when said door is corrugated on one side and hinged to one of the plates, so that said door may serve as a rubbing board, and also as a presser.

78. Cultivators; John Young, Joliet, Illinois.

Claim—1st, The combination of the screw extension on the bottom of the standard, with the oblique slotted castings attached to the front side of the cross-bar of the beam. 2d, The combination of the stationary vertically perforated bar with the adjustable rake or harrow arranged on a cultivator, as set forth.

79. Burglars' Alarm Pistol; John G. Clark, Assignor to self, D. G. Cotting, and Samuel W. Hatch, Augusta, Georgia.

Claim—1st, A pistol, arranged on a vertical suspension guide of a hammer, so that the explosion of its cap and the firing of its charges may be accomplished by concussions of the pistol and hammer. 2d, Holding the pistol suspended by the means and in the particular manner described.

80. Machines for Tempering Clay; J. D. Custer, Norristown, Pennsylvania, Assignor to self and J. M. Roberts, Perth Amboy, New Jersey.

Claim—The arrangement and combination of the stationary toothed rim encompassing the pit, the frame, with the gearing attached to its outer ends, the pinion of the shaft. N, gearing into the rim. and the rod or shaft, F, connected with the frame, the hollow shaft, g, on the shaft, H, and the belt passing around the pulleys, as set forth.

81. Steering Apparatus; Wm. Goodsoe, Assignor to self and Issac Ayres, Manchester Massachusetts.

Claim—The combination of the toothed segment and the curved way, operating as set forth.

82. Stoves; C. Harris and Paul W. Zoiner, Assignors to selves and J. Langstaff, Cincinnati, Ohio.

Claim—The arrangement and combination of the damper, chamber, double-walled case, and pipe, so that the damper which pertains to the oven shall, when drawn out. extend across the bottom of the pipe, and cause the products of combustion to circulate as described, and when closed shall permit a more direct draft.

83. Apparatus for Heating Water; George L. Ingersoll, Assignor to J. E. Ingersoll, Cleveland, Ohio.

Claim—The double cylinder heater, the same being united by the plates so as to form the space for the ascension of the heat, and by the pieces, D E, for the passage of the water, the heating space being covered by the cap, and the parts here named being arranged as set forth. Also, in combination with the two cylinders, the ingress pipe, extending to near the bottom of the cylinder, the exit pipe, and the pipe, in connexion with the pipes, D E, for the purpose of establishing a circulation and rapid heating of the water.

84. Shoe-knives; Ira Merritt, Abington, Assignor to self and L. S. Merritt, Weymouth, Massachusetts.

Claim—The described knife-holder, in combination with an extensible blade, so arranged that as the blade is worn it may be protruded.

85. Spirit Gas Burners; Charles Miller, Assignor to Henry Danford, St. Louis, Missouri.

Claim—The arrangement of the valve over the tube and wick, for the purpose of extinguishing the flame, or regulating its size and altering its direction.

86. Diaphragm for Photographic Cameras; Felix Miller and Alois Wirsching, Assignors to Felix Miller and H. H. Hayden, City of New York.

Claim—The arrangement and combination of the plates, the notched plate, and springs, as described.

[A number of curved plates are placed in a tube in front of the lens, so as to form apertures of different sizes for increasing or diminishing the intensity or sharpness of the light into the camera from the object, in taking photographic pictures.]

87. Power Printing Presses; Jedediah Morse, Canton, Assignor to the S. P. Ruggles Power Press Manufacturing Company, Boston, Massachusetts.

Claim—The improvement in the construction of each of the platen rails, the same consisting in the chute and a notch or depression arranged therein, and with reference to the rollers or tapes, in manner as specified. Also, the arrangement and combination of the slider with the operating cam and the pin or stud on the rocker toggle, such slider being actuated by a foot-treadle, a spring, and the cam of the toggle. Also, the mode of insuring the return movement of the toggles, and their gradual forward motion, after each impression has taken place, the same being accomplished by the notched wheel or its notch. Also, the mode of constructing the gears for operating the frisket-carrier, viz: with the toothed arcs, and the concave and convex arcs, unprovided with teeth. I do not claim the subject of the United States patent No 7205—but I claim the combination of the two, or any other suitable number of wheels, lever nippers (applied respectively to them), and their opening and closing bars, or mechanical equivalents for such bars. Also, the specified mode of constructing each of the nippers for receiving the sheet of paper from the table, viz: so that each jaw may move away from the other while the upper is being raised, the same producing the advantages not only of insuring the passage of the lower jaw underneath the sheet of paper simultaneously with that of the other jaw over it, but of both jaws closing upon the paper at one and the same time, so as not to lift it out of place. Also, the mode of constructing the lower jaw of each pair of nippers, viz: with a lip or bend arranged thereon. Also, the mode of applying and operating each of the points, viz: hinging or jointing it to the table, and combining with it a stop and lever, or the equivalents therefor. Also, the improved method of operating the frisket-carrier, the same consisting in causing it to descend and pass in an inclined position under the delivering tapes and rollers, while the nippers may be approaching the sheet table, the same enabling the press to be made lower and shorter than when the frisket-carriage is moved horizontally under the said delivering tapes or rollers.

88. Machinery for Cutting Comb Teeth; Wm. Noyes, Jr., West Newbury, Assignor to S. C. Noyes & Co., West Roxbury, Massachusetts.

Claim—In combination with the saw, or the same and its peripheral guide or guides, a mechanism or means of pressing or bending the saw laterally. Also, the mode of producing the lateral and longitudinal movements of the carriage of the comb-carrier, viz: by means of the cam and its screw-thread periphery, arranged and operating in conjunction with a rack applied to the said carriage, as described.

89. Machine for Converting Oscillating Motion into Direct Circular Motion; Louis Planer, Assignor to self and Joseph Auger, City of New York.

Claim—The grooved dog having its tail resting in a recess, or equivalent resting place, in the lever, without being pivoted, or otherwise attached thereto, and having a spring applied in combination with it and the said lever, and the whole being applied and combined with the wheel and its axle, as described.

90. Hooks for Vest Chains; Anthony Wallach, Assignor to self and Adolph Wallach, City of New York.

Claim—The clasping hook, in combination with the bolt in the body of the vest chain hook.

91. Moulds for Pressing Glass; Thomas Shaw, Assignor to self and John C. Bailey, Philadelphia, Penna.

Claim—Forming on the plunger a shoulder of a size corresponding to that of the upper edge of the recess in the base of the mould, and limiting the downward movement of the plunger, so that the said shoulder shall coincide or be slightly below the said upper edge of the recess.

92. Plug Bedstead Fastening; Jacob J. Smith, Assignor to self and J. H. Pugh, Philadelphia, Penna.

Claim—1st, A double plug fastening for bedsteads, consisting of the two distinct parts, so constructed as to be adapted for being driven or secured into the post and rail respectively, and also fitted with a wedge-shaped dovetail tenon, and a corresponding groove, operating together so as to cause the end of the rail to be drawn tightly against the post, in the downward pressure of the said rail, after they are connected together. 2d, Making the post-plug with the inclined dovetail groove across in one side of the same, so as to operate in combination with the wedge-shaped tenon on the rail-plug.

MECHANICS, PHYSICS, AND CHEMISTRY.

*Note as to the Relation of Common and Voltaic Electricity.**

By J. J. Waterston, Esq.

In the seventh series of his "Experimental Researches," Faraday treats of the absolute quantity of electricity associated with the atoms of matter, and sums up with a statement as to the quantity of electricity associated with the chemical elements of a grain of water, which has often been quoted since in a way that tends to mislead as to the potential magnitude of the forces involved. There is an example of this in the last (January) number of the *Edinburgh Review*, p. 235, where the following passage occurs:—"Yet they find authority in the mar-

* From the Lond., Edin., and Dub. Philosophical Mag., May, 1859.

vellous fact, well authenticated by Faraday, that one drop of water contains, and may be made to evolve, as much electricity as under other manner of evolution *would suffice to produce a thunder-storm.*" The mechanical value of the chemical force that unites the oxygen to the hydrogen of a grain of water is well known to be about equal to the weight of 7 cwt. exerted through one foot. That such amount of force would *suffice* to produce a thunder-storm is plainly an idea that cannot be entertained; nor is it strictly implied by the words of Faraday, which are—"The chemical action of a grain of water upon four grains of zinc can evolve electricity equal in quantity to that of a powerful thunder-storm." This was written in 1833, when the application of a mechanical standard or work equivalent to molecular forces was but little thought of. To avoid conveying an incorrect impression now, it would be necessary to underline the word "quantity," and add, "but of *incomparably less intensity* than that of a powerful thunder-storm." The idea of the mechanical equivalent of a grain of water being equal to the mechanical equivalent of a thunder-storm would thus be excluded.

The progress of science, and the labors of Harris especially, has since enabled us to obtain some clearer ideas of quantity and intensity as applied to electricity. When the mechanical value of a constant quantity under different degrees of intensity has been ascertained—and this seems practicable with Harris' apparatus—we shall be in a position to estimate exactly the potential relation between voltaic and common eletricity. In the mean time it may be useful to direct attention to certain data which already exist, by means of which we may roughly calculate an approximate result.

The great electric battery of the celebrated Dutch electrician, Van Merum, consisted of 100 jars, each exposing $5\frac{1}{2}$ square feet of coated glass, making altogether 550 square feet. It is stated that this battery, discharged through a length of 25 feet of iron wire $\frac{1}{150}$th of an inch in diameter, fused it so that it was converted into red-hot balls thrown in all directions. Assuming that the heat evolved was sufficient to raise the temperature of the wire 3000 degrees, we have $\frac{1}{52}$ of a cubic inch of iron thus heated; this is equivalent to about $\frac{1}{58}$ cubic inch of water raised 3000 degrees, or 15,000 grains raised 1 degree.

To compare this battery strictly with that employed by Faraday, we should require to know the electric tension of each when charged, as indicated by the same electrometer; also the thickness of the glass in each. Such data are wanting; but, for a rough estimate, we may perhaps assume that they did not differ materially in these particulars.

Faraday states that the quantity of electricity required to decompose a single grain of water is equal to 800,000 charges of a 25 square feet battery, each charge made by thirty turns of a plate-glass machine, 50 inches diameter, in full action. The product of 25 by 800,000 is 20,000,000 square feet of coated glass. This, compared with 550, shows that the quantity of electricity associated with 1 grain of water is upwards of 36,000 times the amount in Van Merum's battery,

and consequently the heating power must be equivalent to 15,000 grains of water raised 36,000 degrees.

According to the experiments of MM. Dulong and Hess, 1 litre, or 61 cubic inches of hydrogen, burned in half a litre of oxygen, gives out heat sufficient to raise 3102 grms. of water 1° C., or 12·3 lbs. 1° F. The water formed by the combustion is 0·00168 lbs. The ratio this bears to 12·3 lbs. is 1 to 7345; so that the heat given out by the combustion of hydrogen sufficient to form 1 grain of water, would raise 7345 grains of water 1° F. in temperature. Comparing this with 15,000 grains raised 36,000 degrees, we arrive at the conclusion that the mechanical value of the electricity required to decompose 1 grain of water is less than $\frac{1}{70,000}$th of the mechanical value of the electricity in the 800,000 charges of the 25-feet battery. Thus eleven charges of this battery represent the integral electric force contained in 1 grain of water.

Edinburgh, February 13, 1859.

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*Durability of Electrotype Work.** By Edward Richardson.

In reply to an inquiry made at the Institute of Architects, as to the probable durability of electrotype metal, and its thickness, and for the information of your general readers, I may state that in 1844, being called upon to furnish metal medallions, &c., for the granite testimonial to Major-General Sir Alexander Dickson, K.C.B., &c., near the Rotunda, on Woolwich-common, a very exposed situation, I suggested electrotype castings. A consultation of officers on the question followed, the results being, full permission to reproduce my models in electrotype copper, which was ably carried out in the depth of a severe winter for me, by Mr. Henry Cox, at Battersea, now local manager of the Lizard Serpentine Company. These castings were at that time of unusual size and thickness, viz: 2 feet 6 inches diameter, and fully an eighth of an inch thick of solid metal. This was effected also without shrinking, and every tool touch from the clay model was reproduced. These works have been now exposed for 15 years; and I believe that 500 will give no perceptible change in them. They weighed, as far as I can remember, thirty pounds each. No chasing was required. Mr. Cox, who, if he sees this, may speak for himself, afterwards executed much more extensive works for the Prince Consort, at Windsor, and other patrons.

On the other hand, I have had, for years, a small brass, about fifteen inches high, of my Templar, William, Earl of Pembroke, produced by the old fire process, which cost me pounds to chase, obliterating every line of my original model, and weighs nearly ¼ of a cwt. When are we to rival our foreign neighbors in this important branch? The zinc Berlin process seems forgotton.

* From the Lond. Builder, No. 845.

*On Professor Hughes' System of Type-printing Telegraphs and Methods of Insulation, with special reference to Submarine Cables.** By Mr. H. Hyde.

(Continued from page 51.)

Discussion.—The Chairman said, in inviting discussion and further inquiry into this interesting subject, he would call the attention of the meeting to one or two points which he thought worthy of observation. The idea of the introduction of this self-curing material was perfectly original, and, as an invention, was very beautiful; but practical men would require it to be put to a very severe test before they adopted it. He believed it to be quite within the range of possibility to introduce a sufficient quantity of that viscid material into a telegraph cable, to effect the purpose which they had seen illustrated upon a small scale that evening, in a manner that must have been highly satisfactory to all present. If a fracture took place in the gutta percha covering at the bottom of the ocean, the cure would be effected without the fact of the rupture ever being known, as it would immediately heal itself. The novelty of this discovery, and its application to such a purpose, was highly honorable to Professor Hughes. They must take it for granted that this semi-fluid was a good insulator; and, as it had the property of hardening upon coming into contact with the water, it was likely to become a most valuable adjunct to gutta percha, which was of a porous nature, and liable to injury from fractures. He also thought the invention would be very valuable as applied to the street wires of electric telegraphs, and these afforded great facilities for testing its value. The mode adopted by Professor Hughes for obtaining synchronism in his instrument was very beautiful and novel. Previous attempts in this direction, though repeatedly made, had hitherto not succeeded. With regard to the rapidity with which the signals could be recorded, it was stated in the paper that the Trans-Atlantic intelligence was conveyed between Boston and New York at the rate of from 2000 to 2500 unabbreviated words per hour, which was equal to about 40 words per minute. There was a point upon which it would be interesting to have some information. It was stated that any number of instruments could be used in the circuit, and that there was the power of cutting off the communication from all the instruments, except the one which was being addressed. Supposing the instruments at the two extremities of the circuit to be in communication; for a moment the intermediate circuit would be interrupted. Was there any movement which indicated to the clerks at the intermediate instruments, the fact that signals were passing through the entire circuit, and must not be disturbed?

Professor Hughes replied that that was so, and there was no fear of interruption from the intermediate instruments.

Mr. Wm. Smith thought the experiments which Professor Hughes had shown of the restoration of the insulation should be tested under pressure; for, after all, the main question was to ascertain how it

* From the Journal of the Society of Arts, No. 334.

would behave under the pressure that was due to the depth of the ocean in which the cable was submerged. This might be done in a closed vessel with a force-pump. He thought there was no difficulty in producing a semi-fluid substance which would become solidified by the action of water; but the question was whether, if they covered the wire with this preparation, and then cut through the gutta percha, the pressure would not force the material through the opening and prevent its acting.

The Rev. WALTER MITCHELL had had the advantage of seeing this experiment tried in private, where it could be conducted with greater care and accuracy than in a public room, and the results were highly satisfactory.

Mr. WM. NEWTON begged to ask whether there was any objection to stating what the nature of this viscid composition was? It would be interesting to the members to know.

Mr. HYDE replied that it would afford him great pleasure to furnish as much information as possible on this subject; but in almost every invention there were certain things which it was expedient to keep to themselves. He would add, with reference to these instruments generally, that there were many things which he might communicate if he could do so in justice to the rights and claims of the inventor. Unfortunately, people did not recognise, as he thought they ought to do, the rights of property in inventions, and for that reason inventors were obliged to keep some things to themselves.

Mr. NEWTON added that Professor Hughes had protected his invention by letters patent; and in his specification he was bound to state, not only in what the invention consisted, but also the means by which he proposed to carry it into effect; and when the specification was enrolled, the inventor must give the full details of it. He would say with regard to this insulation, it had been known for some time in the United States, and he had seen observations in the public prints detracting from its merits. He alluded to that in order to observe that, as far as he could judge, those statements were erroneous, and instead of the invention being valueless, it had been properly designated as an exceedingly ingenious mode of insulating the electric conductor. He agreed with the opinion expressed that it was advisable to make experiments in order to ascertain the manner in which this insulating compound would act under considerable pressure. With regard to the Atlantic cable, he had never had any confidence in it. It appeared to him that any metallic coating on the outside must have some effect upon the conductor inside, especially when the conductor was only protected—as in the case of the Atlantic cable—by an imperfect insulator like gutta percha. Mr. Hyde had stated that gutta percha was a good insulator—a remark which he (Mr. Newton) was surprised to hear from one so well qualified to judge of these matters, because it was generally conceded that gutta percha was only a moderately good insulator. India rubber was much better than gutta percha, which had the peculiar property of becoming charged with electricity after it had been used as an insulator for any length of

time, and was therefore likely to induce leakage. He could mention one or two other modes of insulation which he considered preferable to that of gutta percha, and particularly he would notice the invention of Captains Drayson and Binney, of the Royal Engineers. They proposed, instead of a strand of seven wires, to have a single large conductor, and to cover that with a solution of india rubber paid round with silk, or some other non-conducting substance, and to inclose the whole in a vulcanized india rubber tube which contained a column of air. In a conductor upon that principle they had, in the first place, the insulation of the india rubber; secondly, the insulation of the silk; thirdly, that of the air; and, finally, that of the outer india rubber tube. This appeared to him to form a perfect insulator of the electric wire. There were other insulating compositions which had come under his notice professionally, one of which was that of Mr. Leonard Wray, who proposed to make a composition formed of india rubber or gutta percha, mixed with silicious matter, and a resinous substance such as shell-lac. This appeared to him to contain all the elements of a good insulator. He was not, however, aware that this plan had been tested to any great extent. Another method had been introduced by Mr. McIntosh, but he did not consider it so practical as the others to which he had alluded.

Mr. Hobbs remarked that there was novelty in the idea of the material being forced out by the pressure of the water, as stated by some of the speakers. If there was a hole through the gutta percha, he apprehended the pressure on the hole would be the same as the pressure on any portion of the cable, and he could not conceive how, under such circumstances, the semi-fluid matter was to be forced out.

Mr. Newton would add, with reference to the remarks of the chairman, that this plan would be applicable to underground telegraph wires—that it appeared to him (Mr. Newton,) to require the action of water to solidify the viscid fluid, and, as far as he understood, it would not harden by simple exposure to the air.

The Chairman replied that a simple wound in the gutta percha covering would not be injurious to insulation in a land telegraph wire. The injurious effect would only take place in the event of water getting into the pipe. The moment the wound in the gutta percha rendered the insulation imperfect, the water would have the effect of healing the wound by its action on the viscid fluid.

Mr. Thos. Winkworth would take the liberty of asking one or two questions. Should any fractures occur in the cable, what provision was made for the fresh supply of the semi-viscid fluid which exuded or oozed out?

The Chairman.—When it is exhausted you cannot put in a fresh supply.

Professor Hughes explained that there would be no more fluid exuded than was sufficient to fill up the space which was cut out. If they cut the gutta percha in the open air, no more fluid would ooze out than would be enough to fill the space, and therefore the quantity in the tube would be sufficient to fill up an innumerable number of small fractures.

The Chairman—Does the fluid harden by exposure to the air?

Professor Hughes—No; but it could be easily made to do so.

The Chairman was still of opinion that it would be valuable as applied to land telegraph communication. He would inquire whether the application of the semi-fluid matter was very expensive?

Professor Hughes replied that the cost was something below that of gutta percha. It could be placed within two coatings, or between the wire and the single outer coating.

Mr. Hobbs would ask what effect time would have upon this material? The substance might be very good when first applied, but in time its properties might be destroyed.

Mr. Hyde replied that time must answer that question. He was not able to do so at present.

Professor Hughes said it had been tried under water for three months, and had been exposed to the atmosphere for six months, without any change whatever having taken place. It was not injured by the action of the atmosphere.

Mr. Winkworth would further inquire whether the printing instrument was in practical use for any great length of land wire, and on what length of circuits it had been worked?

Professor Hughes said it was in practical use in the United States on six telegraphic lines when he left America, and that it had been worked over a circuit of 600 miles without relay. The right to use the instrument had been purchased by companies possessing 30,000 miles of telegraph in America.

Mr. Winkworth would like to be informed whether the instrument had been tried upon submarine wires; and if so, to what extent in length, and with what rapidity?

Professor Hughes said it had been worked upon the Atlantic cable while coiled at Keyham, and also upon the Red Sea and Australian cables, through their entire length.

The Chairman inquired whether those experiments had taken place in the presence of witnesses.

Professor Hughes said they were witnessed by several persons.

The Chairman added that it was satisfactory that Professor Hughes was able to state that the experiments were witnessed by several persons, as he was not aware that that fact had ever before been published. It was gratifying to know that messages were passed through the entire distance.

Mr. Hyde stated that the experiments were continued for several weeks during the shipping of the Atlantic cable at Keyham, in May last. The transmission of messages through the Atlantic cable was at that time slow, and at a much less rate than the instrument would be capable of accomplishing at the present time. Professor Hughes had made no experiments upon long submarine lines until he came to this country, and the first experiments were made upon the Atlantic cable. The instruments were timing instruments, and the rate of speed must be proportioned to the rate at which the electric wave would travel through the wire. When he was in America, he learnt from the elec-

trician's report to the Company that the rate at which the electric wave would travel through the Atlantic cable was equal to four words per minute with the ordinary Morse relay. The instrument of Professor Hughes, intended for land lines, would not move correctly at this slow rate, and therefore instruments were specially made with a minimum rate of speed of four words per minute, in accordance with the electrician's report. When Professor Hughes arrived at Keyham, he found that the rate at which signals could be transmitted through the Atlantic cable was less than had been stated in the report, and the instrument was not adapted to so slow a motion. After reducing it by temporary arrangements, he was able to transmit letters at the rate of two and a half words per minute. This was done in the presence of Mr. Field, the managing director, and some half-dozen other persons. Since that time the instrument had been tried upon the Tasmanian cable, 240 miles in length, and through that they worked 25 words per minute. Subsequently, experiments were made upon the Red Sea Cable, 1780 nautical miles in length, or nearly 2000 statute miles. Upon that cable they worked with perfect success, day after day, for a week, first upon 500 miles, then upon 800, then upon 1500, and finally upon the whole length of 2000 miles. The rate of speed through the entire length was between four and six words per minute. The rate over 1000 miles was from eight to ten words per minute; through 500 miles it was twenty words per minute. With reference to the semi-fluid substance, he had no desire to keep back any useful information, but they had been trying experiments for four months, in order to ascertain what combination of materials was best adapted for the purpose. Mr. Newton had referred to a cable constructed with a long tube filled with air as a non-conducting element. It appeared to him (Mr. Hyde) that as an insulator, the air would be far inferior to the fluid substance, or even to gutta percha. He also thought that if any fracture occurred in the coating, the pressure upon it would be such that the air would be displaced by the water. On the other hand, Professor Hughes had been seeking and had obtained a semi-fluid substance, every portion of the ingredients of which would be heavier than water. He would say with reference to the semi-fluid substance, that almost anything would make a semi-fluid substance. The question was—what was the best material? and this he did not feel disposed at present to develop. He would only say that ordinary oil or hydro carbons mixed with resinous substances would produce such a semi-fluid substance as would restore insulation. The merit of the invention consisted in the idea of the use of a semi-fluid material for this purpose, and not so much in the material used. Mr. Smith had suggested that means should be taken to test the action of this material under heavy pressure. His (Mr. Hyde's) impression always had been that the pressure would be equal upon all parts of a submerged cable, and therefore the fluid would be in the same position under a pressure of two miles depth of water as under two feet in a bath. They had, however, gone almost to the extent proposed by Mr. Smith. They had made the experiment with a pressure equal to

that of 3000 fathoms, or two miles, with perfect success, with the gutta percha incised before it was submerged. In one case the gutta percha was split from end to end and it came out perfect.

Mr. BEVAN referred to the recent experiments upon insulation made at the works of Messrs. Silver & Co., at North Woolwich. As far as he understood it, the insulation was effected by india rubber, and if a puncture occurred in the tube it would by the pressure be healed. Some credit was therefore due to the plan as being prior to that of Professor Hughes.

Mr. NEWTON said experiments as to the effect of pressure had been tried with the cable as designed by Captain Drayson, and it was found that with a pressure exceeding that of two miles below the surface, a puncture being made in the tube, the air was not expelled from it. In the case of a small fracture, such as a crack, it did not appear that the air escaped even when under hydraulic pressure.

Mr. HYDE was very glad to hear it; he thanked Mr. Newton for having mentioned the different modes of insulation that had come under his notice. He (Mr. Hyde), however, was not there for the purpose of criticising the inventions of others, but to illustrate and defend those of Professor Hughes.

Mr. SMITH said the question was, whether the material would exude from the tube, when cut whilst under pressure; he knew that in some experiments that were tried the fluid did exude. The cut was made whilst under pressure, and there was no balancing of the forces until some of the fluid had exuded, and some alteration in the dimensions had taken place.

Mr. TUCKETT submitted that upon the principle of hydraulic pressure, if the surface of the whole tube were greater than the surface which was not protected, the pressure being in proportion to the area, there must be exudation, and there would be a tendency to press the liquid out of the hole.

Mr. J. G. APPOLD, F. R. S., said, experiments showed that there was no exudation. It made no difference whether it was under pressure or otherwise.

Mr. HYDE, to meet the hydraulic point that had been raised, would ask whether the pressure upon each point would not be the same? To get the fluid to ooze out, they must have a point free from pressure. The pressure was equal on all parts of the cable.

The CHAIRMAN said, this point had been proved by experiment.

Professor HUGHES remarked that the fluid, being heavier than water, was not displaced by the water.

The CHAIRMAN would wind up this discussion with a few observations, one being not so much applicable to telegraphic communication as to the objects and action of this society. When he first joined the Society, about 24 years ago, before the revolution in its operations took place—for it was more than a reformation—no patent scheme could be brought before the Society. It must have been an invention thrown open to the world. The revolution to which he had alluded, brought about a great change in this respect; and he thought one of

the greatest boons the society now conferred, was the encouragement it gave to patentees to come with their inventions as soon as they were in a condition to do so, and allow them, as had been done by Professor Hughes and Mr. Hyde that night, to give them such information as they could, without injury to their interests. Mr. Newton had a perfect right to ask for the information he was desirous to obtain; but, at the same time, there was no improper selfishness in Mr. Hyde refusing to communicate it; he had a perfect right, if he chose, to keep the secret to himself. The application of india rubber for the purpose of insulation was not new; it had been used in single, double, and treble coats for the last 20 years. The great improvement consisted in thoroughly uniting the edges of the india rubber by means which could not injure it in its non-conducting character, or lead to the ultimate decomposition of the material itself. The solutions formerly employed for the purpose were injurious to it; and he was happy to say there were two or three plans then under consideration which gave good promise of success. These, however, had nothing to do with the beautiful idea of placing within the gutta percha a material capable of healing those wounds which arose from the defects existing more or less in all impure gutta percha—such as air bubbles, small particles of fibres, or wood, or indeed from any defect whatever. He was sure he was only expressing the feelings of the meeting in proposing a vote of thanks to Mr. Hyde for the paper he had read, and also to Professor Hughes for the illustrations he had given of his beautiful apparatus, and the explanations he had afforded upon this very interesting subject.

A vote of thanks was then passed to Mr. Hyde and Prof. Hughes.

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*Coal as an Aid to Industrial Progress.**

Questions of high economical value arise out of the possible development of the great coal fields of the United States, which comprise no less than 196,850 square miles—added to which the British provinces contain 7530 square miles. These coal areas are amazing and may be productive of immense commercial results in the far future. When we reflect upon what has been acheived by the produce of the coal fields of Britain, mere specks compared with those of the United States, and in figures amounting only to 5400 square miles,—when we further consider the total coal fields of Europe, and find them only 8964 square miles—and then endeavor to anticipate the mining of the enormous fields of the United States upon an extensive scale, we are led to forecast a future of almost boundless enterprise for that wonderful country. An estimate of the probable produce of the American coal fields may be formed from some data afforded in an excellent work just published by Prof. Rogers, on the Geology of Pennsylvania. Averaging the total thickness of the workable coal in Great Britain at 35 ft., we have a total of workable coal equal to 190,000,000,000

* From the Lond. Mining Journal, No. 1230.

tons. In the same way, estimating the total area of the *productive* coal fields of North America as 200,000 square miles (that is inclusive of the British provinces) and averaging the thickness of good workable coal at 20 ft., a result of 4,000,000,000,000 tons is gained, Or, to make these results more appreciable, if we take the amount of workable coal in Belgium as 1, then that in all the British Islands is rather more than 5, that in all Europe $8\frac{3}{4}$, and that in all the coal fields of North America is 111. This method of ratio is more intelligible than that of relative superficial magnitudes—and we at once perceive that the United States possess more than twenty-two times our amount of coal. We apprehend, however, when mining discovers more fully the character of the American coal, that the superiority of our best bituminous coal will in a large measure compensate for our smaller quantity.

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*On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure rapid and certain communication.** By S. Alfred Varley, Assoc. Inst. C. E.

(Continued from page 61.)

The correctness of considering the inductive phenomena which manifest themselves in subterranean and submarine circuits, as a new fact suddenly brought to light, has been called in question in the early portion of this paper; a few words on its history will therefore not be out of place, before considering the way in which it affects telegraphing.

In 1838, Dr. Faraday pointed out the conditions which would cause the retardation of an electric impulse in its passage through a conductor.

In 1848, the electric telegraph was in actual operation. The method adopted at that time for the insulation of the wires passing through towns, was to enclose a number of cotton covered wires in a leaden tube, and then fill the tube with a mixture of resin and Stockholm tar.

Reasoning on Dr. Faraday's observations, my brother, Cromwell Varley, was led to think that such circuits possessed conditions favorable for induction to manifest itself; he therefore searched for it, and succeeded in obtaining indications of induction.

In 1849, gutta percha had been introduced, and as the insulation in gutta percha covered wires was much more perfect than in the cotton covered ones enclosed in leaden pipes, induction manifested itself much more strikingly, and my brother made use of, from that time as a more searching test of perfection of the insulation than the deflection of a galvanometer, the capability of the wire to retain for a certain period the induced charge, and he stood alone for some time in making use of this test, others not having faith in it at that period, and in the same year he obtained indications of induction in an overground circuit.

In the latter end of the year 1851, my brother was enabled to experiment upon a length of ten miles of gutta percha covered wire.

* From the Jour. of the Society of Arts, No. 332.

At these experiments I assisted, and the conclusion he arrived at was, that if gutta percha covered wires were employed for circuits of any length, as was at that time proposed, induction would manifest itself so powerfully, as to offer serious obstacles to telegraphing with the apparatus then in use, the truth of which prediction was subsequently verified. In Prussia, however, as early as 1850, Mr. W. Siemens had employed gutta percha covered wires for circuits of considerable lengths, and encountered the inductive phenomena, an account of which he published during that year.

This fact was not known on this side of the channel until after gutta percha covered wires throughout the whole lengths of the circuit were also employed in this country, and that was in the year 1854.

To Dr. Faraday, however, is due the whole credit in this matter, and I have only alluded to its telegraphic history, as I cannot help feeling it as a sort of reproach to practical electricians that it should go forth that induction, which was manifesting itself step by step before their eyes, came suddenly and unexpectedly upon them. The following extract from Dr. Faraday's researches of 1838 is so instructive, and teaches such a valuable lesson, that I cannot refrain from quoting it. Alluding to Professor Wheatstone's well-known experiment, he says,—"If the two ends of the wire were immediately connected with two large insulated metallic surfaces exposed to the air, so that the primary act of induction, after making contact for discharge, might be in part removed from the internal portion of the wire at the first instant, and disposed for the moment on its surface, jointly with the air and surrounding conductors; then, I venture to anticipate, the middle spark would be more retarded than before, and if these two plates were the inner and outer coatings of a large jar, or Leyden battery, then the retardations of that spark would be still greater."

Previous to the first attempt to submerge the Atlantic cable, a series of experiments were undertaken by the company's late electrician, and the result published.*

These experiments having been tried, at the expense of much capital, and with opportunities which never before presented themselves, are too important not to be noticed, though it is believed that the author of them has lately had reasons to modify some of his conclusions.

The chief results published were these:—

1. That no adequate result is obtained by increasing the sectional area of the conductor; that, in fact, in the case of a submarine circuit —a small wire will transmit signals more rapidly than a larger one.

2. That an insulated submarine wire conducts according to a different law to that of a suspended circuit.

3. That the rate at which a voltaic signal travels is not affected by the intensity of the battery.

4. That magneto-electric induced currents have the property of traveling in the first place faster than voltaic ones; and, unlike voltaic currents, when their intensity is increased their rapidity of traveling is increased also.

* *Vide*, "The Atlantic Telegraph. A History of Preliminary Experimental Proceedings, &c., published by order of the Directers of the Company."

In the paper I submitted last March to the Institution of Civil Engineers, I pointed out what I conceive to be errors in these results, and endeavored to show that some of them necessarily followed from the way in which the experiments were conducted, and I cannot more clearly express what I wish to convey on this head than by quoting my own remarks on that occasion.

"In examining these conclusions, it has first to be considered whether the conditions of a submarine circuit and a suspended one are different. In a suspended wire, the insulating medium of the air takes the place of the gutta percha of the submarine circuit. The earth, which is the nearest conductor, is a considerable distance off, and is only on one side of the wire, therefore but little induction can take place between the wire and the earth; nevertheless, induction to a certain extent does take place, and can be perceived in circuits of very moderate length.

"The author has noticed indications of it in a circuit 60 miles long, and he feels confident that with delicate apparatus it could be perceived in much shorter circuits. If the distance between the wire and the earth were decreased, induction would be developed more strongly, and the wire could be brought down step by step until the condition of a submarine circuit would be approached, where the earth surrounds the circuit on all sides, and is only separated from it by the thickness of one-eighth or three-sixteenths of an inch of gutta percha—a substance possessing, moreover, specifically a much greater inductive capacity than air. It, therefore appears, that the conditions are precisely the same, only differing in degree. Before proceeding further, and to prevent the possibility of mistake, it is desirable to make the following quotation from the work previously referred to:—*

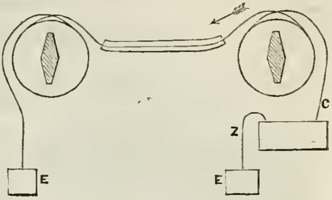
"'The law of squares may possibly apply to the transmission of electricty freely along simple conducting wires, but it certainly does not apply to the case of its transmission along submarine and subterranean gutta percha covered wires (the facility of transmission being estimated by rate of speed) because in this the case is not one of simple conduction, but of transmission, after the wire has been charged inductively to saturation as a Leyden jar.' This quotation shows clearly the reason for concluding that small wires are better conductors for submarine circuits, as far as transmission is concerned, than larger ones; for the smaller the Leyden jar the more quickly will it be charged to saturation. The author, in differing from these conclusions, does not wish it to be understood that he thinks the law of squares is applicable to submarine wires; for he is not aware of any electrical phenomena which obey that law, but he submits that there is a material difference between a Leyden jar and a submarine wire.

"In a Leyden jar the inner and outer coatings are perfectly insulated one from the other. If they were not insulated there could be no statical charge, as is well understood by all electricians. Induction therefore *involves insulation.* But in a submarine circuit this is not the case. If the wire at the further extremity was disconnected from the telegraph instrument, and sealed up with gutta percha, the condi-

* *Vide*, "The Atlantic Telegraph," page 23.

tions would be nearly the same. In practice, however, it is quite open through the instrument to the earth, and the resistance opposed by the very long length of wire is the only insulation between the inner and outer coatings, for it unites both, being in connexion with the earth at both ends (Fig. 5). It is therefore evident that if the wire offers no resistance there will be no insulation, and, as a consequence, no induction to retard the passage of the current. It is also equally plain that precisely in proportion to the resistance which the wire opposes, provided always the insulating medium be of the same thickness, will induction manifest itself and retardation be experienced.

Fig. 5.



"There is also another difference between a Leyden jar and a submarine circuit.

"The Leyden jar is charged uniformly all over, whilst in a submarine wire the tension of the charge varies in different portions of the circuit, being at its maximum at the end where contact is made with the battery, and dying off to nothing at the further extremity."

The next consideration is the part induction plays in submarine circuits of any considerable length.

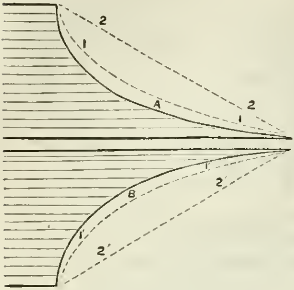
In a submarine circuit the wire is insulated from the earth by only a thin layer of gutta percha; the conditions, therefore, are favorable for induction through the insulating material; the conductor, itself, from its great length, opposes very great resistance, or, in other words, insulates to a very considerable extent.

When a battery is connected to send a current, the first impetus is in part directed forward, in part diverted laterally; but as the wire opposes considerable resistance to the passage of the electricity which the battery can generate, whilst the thinness of the insulating material is very favorable for induction taking place through it, the greater portion of the first rush will be occupied in charging the wire statically at the battery end; as, however, it is a balance of forces between the resistance which the wire opposes on the one hand, and the ease with which lateral induction can take place on the other, a very minute portion must pass through instantly, and the period which will elapse between the making contact with the battery and the observing the current at the further extremity, will depend upon the capability of the instrument to record very small quantities of electricity.

In fact, immediately on contact being made with the battery, a wave will be formed throughout the length of the wire, somewhat like what is shown in the diagram (Fig. 6), which is intended to represent a submarine wire the moment after contact has been made with the battery. The line A represents the internal charge having its maximum tension at the battery end, and diminishing in intensity as it approaches the

farther extremity. The line B shows the induced charge of the opposite kind on the outer surface of the gutta percha, and forms an exact counterpart to the internal charge, with the exception of being a little less intense; for as it is spread over a greater surface, and only exactly balances the internal wave, its tension will be less in proportion as its surface is greater. As the tension of the statical charge is raised, so will the flow of electricity at the further extremity increase; both will arrive at their maximum together; the current will then flow in a regular stream as long as contact with the battery continues. The dotted lines 1 1 and 1′ 1′ are intended to represent the waves after the contact has been made a short time, and the lines 2 2 and 2′ 2′ are intended to represent the waves when they have attained their maximum height.

Fig. 6.



In the last case they will be perceived to be more regular.

When the battery has been disconnected from the wire, the opposite waves will still continue to unite, but the rate of flow as the tension falls will become slower and slower.

In theory the time which would be occupied by a wire discharging itself completely in this way would be infinite. In practice the wire requires a very appreciable time to charge, and a longer period to discharge. The effect of this is, that if currents are sent at all rapidly one after the other, instead of obtaining a series of distinct impulses at the further extremity, an undulating continuous current is received; and, as to obtain a telegraphic signal, the wire has not only to be charged to a certain degree of tension before an appreciable current is received at the further end, but has also to be discharged afterwards before another signal can be sent, the impulses which are obtained through such circuits as these are very sluggish.

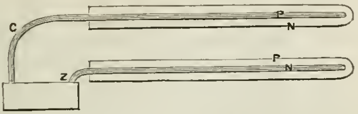
The problem to be solved is, the best means of reducing the amount of induction, and of mitigating its effects.

Almost the first remedy suggested when this inconvenience was experienced, was to substitute another insulated wire in the place of the earth for a return circuit, for it was argued that, as in this arrangement, one wire would be charged positively and the other negatively, they would neutralize one another.

This suggestion was put to the test and failed. Since that time the same plan has been revived by several others; a good deal of argument has also been brought forward lately in support of it, and even amongst those who know its practical inutility there would seem to have been lurking some faith in the capability of the method (in theory at least,) to neutralize the effects of induction.

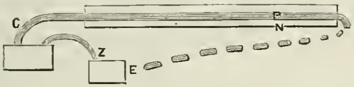
The explanation of its failure, if we are guided by the first principles of the science, appears to me to be very simple, and I expect not only to make it plain that no advantage is to be obtained by the adoption of this method, but that it will increase the retardation.

Fig. 7.



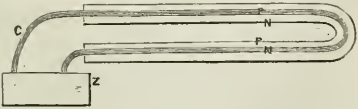
Let two long gutta percha covered wires, (Fig. 7,) buried in the earth, be connected, one with the zinc pole and the other with the copper pole of a battery, and let the farther ends of each of these wires be hermetically sealed. The earth, from its mass, being a perfect conductor, its action, it is evident, will be the same as if metal tubes in metallic communication with each other surrounded the gutta percha wires. It is therefore clear that the only retardation to induction will be the thickness of the gutta percha covering, and the tension of the statical charge will be in accordance with the intensity of the battery. Now consider the case of a similar gutta percha wire of the same length (Fig. 8) as one of these, but in which one pole of

Fig. 8.



the battery is connected to the earth and the other to one end of the metallic conductor, and the circuit completed by connecting the further extremity to the earth. It will also receive a statical charge to a certain degree, but the tension of the charge will not, *ceteris paribus*, be dependent upon the intensity of the battery, but upon the resistance which the wire opposes, for it has already been shown that this is the only real insulation between the wire and outer coatings, and that the degree to which statical charge can take place depends on the amount of insulation existing.

Fig. 9.



Now, let the ends of the two wires which are hermetically sealed be connected to each other, (Fig. 9,) the circumstances are quite as favorable for induction as in the wire in which one end was connected with the earth, but there will be twice the resistance; in other words,

double the amount of insulation, and, consequently, a proportionate increase in the amount of induction.

Another view of this matter will perhaps assist to confirm what has just been stated.

It is a well established fact that when a telegraphic circuit is composed of a loop of wire, it will oppose the same resistance as a circuit of double the length where the earth is made use of in the place of a return wire, and this proves that the earth offers no appreciable resistance. If this be the case, what difference can it make whether the battery pole be carried to the end of the wire itself, or through the medium of any length of a perfect conductor, which the earth has been proved to be? Therefore, it would appear that the induction which would be manifested in a circuit composed entirely of an insulated conductor, would be the same as that in a circuit of twice the length, where one-half the circuit is completed by the earth, and the only difference which would exist between the one and the other would be, that in a circuit composed entirely of wire, the statical charge will be distributed more uniformly throughout the entire length.

But, says a writer on this subject, I admit that no advantage would result if two separate wires are used, and which will therefore necessarily be some distance apart from one another, but place the two wires in the middle of a mass of gutta percha, (Fig. 10,) and so close to each other that they may become virtually the centre of a system, and let the insulating material be of considerable sectional area, then no induction worth naming will take place between the wires and the earth, and the inductive influence of the positive wire will neutralize that of the negative wire.

Fig. 10.

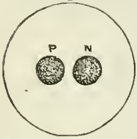
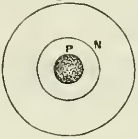


Fig. 11.



The fallacy of the proposition will be at once seen if it be carried out more fully. Instead of letting the wires lie side by side, let the one wrap over the other, and be, in fact, a tube with a thin mass of insulating material between it and the inner wire (Fig. 11.) They will now become really the centre of the system, and fulfil completely the object desired by the author of this suggestion, but is it not evident that such an arrangement is the fac-simile of a Leyden jar, and will not the conditions be the most favorable that can be conceived for the development of induction?

The only remedy which has been successful in mitigating the effects of induction, is that of throwing into the wire, immediately after a current has been sent, another of the opposite kind; this absorbs and neutralizes the preceding wave much more quickly than when the wire is left to discharge itself in the ordinary way. This method, however, does not reduce the induction, but only mitigates its effects, although in circuits of moderate length its adoption has, for practical purposes, completely removed the inconveniences arising from the induced charge.

(To be Continued.)

For the Journal of the Franklin Institute.

Particulars of the Steamer Yorktown.

Hull built by Wm. H. Webb. Machinery by Morgan Iron Works, New York. Intended service, New York to Richmond.

Hull.—		
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		250 feet.
Breadth of beam at midship section,		34 "
Floor timber—molded, 15 ins.—sided, 15 ins.		
Frames—apart at centres, 2 feet 6 inches—strapped with double laid iron straps, $4\frac{1}{2} \times \frac{3}{4}$ inches.		
Depth of hold,		9 " 6 inches.
" to spar deck,		17 "
Length of engine and boiler space,		78 "
Draft of water at below pressure and revolutions,		11 "
Area of immersed section at this draft,	330 sq. ft.	
Tonnage,	1400.	
Contents of bunkers in tons of coal,	150.	
Masts and rig—Fore-topsail schooner.		
Engines—Vertical beam.		
Diameter of cylinders,		50 inches.
Length of stroke,		10 feet.
Maximum pressure of steam in pounds,	25.	
Cut-off—half stroke.		
Maximum revolutions per minute,	20.	
Boilers—Two—Single return through two tiers of flues.		
Length of boilers,		34 feet.
Breadth "		14 "
Height " exclusive of steam chimney,		12 " 6 inches.
Number of furnaces,	6 in all.	
Breadth "		4 " 2 "
Length of grate bars,		7 "
Number of flues,	28.	
Internal diameter of flues,		19, 16, and 11 "
Length of flues,		27 and 21 feet.
Heating surface (fire and flue),	6000 sq. ft.	
Diameter of smoke pipe,		6 feet 8 "
Height "		39 "
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per day,	26 tons.	
Paddle Wheels.—		
Diameter,		30 feet.
Length of blades,		9 "
Depth "		18 inches.
Number "	26.	

C. H. H.

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*Chromo-Photography.**

An invention which is destined, no doubt, to create a revolution in the art of photography has recently been made by Mr. Backshell, of the Photographic Institution, Durham-place, Dalston, and which has received the protection of her Majesty's royal letters patent. It consists in producing, what has hitherto been considered impossible, a

* From the Lond. Mechanics' Mag., Sept. 1858.

beautifully-colored non-inverted photograph, equal in brilliancy of color and superior in detail to the most exquisite miniature extant. We understand that the studio of Mr. Backshell has been honored by the visits of several of the nobility and gentry, who have testified their appreciation of the invention by numerous orders. Licenses for the practice of the invention are being granted throughout the kingdom.

For the Journal of the Franklin Institute.

Particulars of the Steam Frigate General Admiral.

Hull built by Wm. H. Webb. Machinery by Novelty Iron Works, New York. Intended service, Imperial Russian Navy.

Hull.—		
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		308 feet 6 inches
Breadth of beam at midship section,		54 " 6 "
Depth of hold to berth deck,		18 " 3 "
" " spar "		33 " 7 "
Floor timber, at throat—molded, 1 ft. 10 ins.—sided, 16 to 25 ins.		
Frames—apart at centres, 3 feet 2 inches.		
Length of engine and boiler space,		104 "
Draft of water at load line,		23 " 6 "
" below pressure and revolutions,		22 "
Area of immersed midship section at this draft,	836 sq. ft.	
Tonnage, custom-house,	4306 92-95.	
Contents of bunkers in tons of coal,	650.	
Masts and rig—ship rigged.		
Engine.—Two—Horizontal—Back action.		
Diameter of cylinder,		84 inches.
Length of stroke,		3 feet 9 "
Maximum pressure of steam in pounds,	20.	
Cut-off—half stroke.		
Maximum revolutions per minute,	52.	
Weight of engines,	175 tons.	
Boilers.—Six—Horizontal tubular.		
Length of boilers,		10 " 3 inches.
Breadth "		19 and 22 "
Height " exclusive of steam chimney,		12 " 6 "
Weight of " without water,	250 tons.	
Number of furnaces,	38.	
Breadth "		2 " 7 "
Length of grate bars,		7 " 6 "
Number of tubes,	2760.	
Internal diameter of tubes,		3 "
Length of tubes,		7 "
Heating surface,	21,000 sq. ft.	
Diameter of smoke pipe,		11 "
Height "		65 "
Draft,	Natural.	
Consumption of coal per hour, maximum,	4 tons.	
Propeller.—		
Diameter of screw,		19 feet.
Pitch "		31 "
Length of blades,		7 "
Number "	two.	
Geared—Direct action.		

C. H. H.

*Production of Engravings by Photography.**

There are, as is now tolerably well known, two or three processes for the production of engravings by photography—the chemical agent in them being the bichromate of potash. M. Jobart not only introduces a material new for this special purpose—but he has shown that the well-known material, the iodide of silver, possesses a new property which renders it available to this end. A lithographic stone, or a plate of zinc, is covered with the iodide of silver, and a picture obtained upon it in the usual manner. It is then immediately covered with a thick solution of gum arabic mixed with lampblack and placed aside in the dark. When the coating of gum is thoroughly dry the stone or the zinc plate is plunged into water. The parts over which the iodide has been decomposed are removed with the gum, and all those parts receive the lithographic ink readily, while the other parts resist it. Thus the stone or zinc plate is at once prepared, and, says M. Jobart,—who makes this communication to the Academy of Sciences of Paris—we obtain thus the whites pure and the proofs perfect in all their details—but the operation is a delicate one.

Mineral Statistics of Great Britain.†

An interesting return has recently been published by order of the Lords Commissioners of the Treasury, by the Museum of Practical Geology, showing the quantity of mineral ore obtained from the British mineral districts during the past year. The following are the principal points of interest:—The quantity of pig iron made in 1857 was 3,659,447 tons,—being an increase, notwithstanding the depression of the iron trade, of 73,070 tons over the quantity produced in 1856. The importations of tin ore, including 816 tons from our colony, Victoria, amounted during the past year to 4095 tons. Under the head of copper there is considerable difficulty in arriving at a just estimate of the produce, from the circumstance that very large quantities are purchased by private contract, alike from British and Foreign mines, and it is almost impossible to separate these. It is believed, however, that this has been more closely effected in the present return than has been done in any former year. The purchases of the Copper Company in Cornwall, for 1857, show a decrease of 1414 tons; and those in Swansea, of 840 tons upon the previous year. The exports have been in 1856, 22,863 tons; and in 1857, 25,241 tons. The production of lead has been, in 1856, 73,129 tons; and in 1857, 69,266 tons;—of silver in 1856, 614,188 oz.; and in 1857, 532,866 oz. The importations of lead exhibit a falling off of about 3000 tons; and of foreign silver ores, instead of 6,636 tons, the quantity brought into this country in 1856, we only imported 5190 tons,—being a decrease of 1440 tons. The return of coal production is a remarkable test of the depression of commerce during 1857. For while the quan-

* From the Lond. Athenæum, Feb., 1859.
† From the Lond. Athenæum, December, 1858.

tity produced and sold in 1856 amounted to 66,645,450 tons, that of 1857 was only 65,394,707 tons,—being a falling off of 1,250,743 tons. The following tables show the values of the mineral and metallic produce of the United Kingdom in 1857, excepting clays and stones:—

MINERALS.

Tin ore,	£ 743,508
Copper ore,—the product of all the sales, excluding foreign ores, but including private contract purchases,	1,560,922
Lead ore (containing silver),	1,428,095
Zinc ore,	30,982
Iron pyrites,	63,804
Arsenic,	919
Nickel and Cobalt,	219
Iron ore,	5,265,304
Coals,	16,348,676
Salt,	506,720
Barytes and other minerals,	12,500
	£ 25,961,649

METALS.

Tin,	£867,680
Copper,	2,166,900
Lead,	1,523,852
Silver,	133,216
Zinc,	450,000
Pig iron,	12,838,560
Other metals,	125,500
	£ 18,105,708

The returns have been compiled by Mr. R. Hunt, and comprise many details of considerable interest.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 21, 1859.

John C. Cresson, President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter from the American Institute, of the City of New York, was read.

Donations to the Library were received from the Commissioners of Patents, the Royal Astronomical Society, and the Statistical Society, London; the Catholic University of Ireland, Dublin; des Oesterreichischen Ingenieur-Vereines, der K. K. Geologischen Reichsanstalt, der K. K. Geographischen Gesellschaft, Vienna, Austria; the Board of Arts and Manufactures for Lower Canada, Montreal, Canada; Prof. A. D. Bache, U. S. Coast Survey, Washington, D. C.; Hon. David Dale Owen, Little Rock, Arkansas; the American Institute, City of New York; the North Missouri Railroad Co., St. Louis, Missouri; B. H. Latrobe, Esq., C. E., Baltimore, Maryland; the Board of Water Commissioners of the City of Detroit, Michigan; the N. O. Academy of Science, New Orleans, Louisiana; the Young Men's Mercantile Library Association, Pittsburgh, Penna.; Messrs. Jones, White, and McCurdy, Prof. John F. Frazer, and the Board of Trade, Philada.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of June was read.

The Board of Managers and Standing Committees reported their minutes.

One resignation of membership in the Institute was read and accepted.

Candidates for membership in the Institute (8) were proposed, and the candidates (7) proposed at the last meeting were duly elected.

The President made a brief statement relative to the hail storm and tornado which passed over the northern part of the City on the afternoon of July 20th.

From an elevated position he had a full view of the storm when distant about 6 miles to the N. W. A portion of the cloud, apparently about half a mile wide, appeared pendant from the main body, reaching to the ground; within this chimney-like column there was evidently a violent upward movement, the masses of cloud being carried up with great velocity as soon as they formed, and vivid streaks of lightning traversed vertically near the centre of the column.

The form of the whole cloud was that of an enormous mushroom, with a stem more than 2000 feet in diameter, and a head several miles across.

Mr. Wm. Stacey exhibited a spring balance, designed by Mr. Dana Bickford, of Westerly, R. I., as a substitute for the weights ordinarily used to balance window sashes; it consists of a coiled spring contained within a cylindrical band, to which its outer extremity is attached, whilst its inner extremity is attached to a fixed pin, about which the band rotates; the whole is mounted in a box which is intended to be let into the window frame near the top of the sash. A cord is attached by one end to the sash, whilst the other is attached to the band enveloping the spring, which is wound up, so as to give a tension sufficient to balance the sash. It is claimed to be cheaper than the old method, as no boxing is required for the weights.

Also, Mr. A. W. Decrow's safety alarm drawer lock, which can be put upon an ordinary drawer at a slight expense. The alarm is operated by the endeavor to open the drawer, unless three projecting pins on the under side of the drawer, which permit of combinations, are moved into the propor positions by the fingers as they fall upon them in the act of pulling the drawer outwards. In that case, the drawer opens without noise; but, if the combination is not the proper one, a catch, which projects upwards within the drawer, not only prevents the opening, but, by its contact with the containing frame of the drawer, releases a catch which sets a bell ringing, thus notifying the proprietor.

Messrs. Code, Hopper & Co., had upon the exhibition table, for inspection and trial by the members, a spirometer registering to the tenth part of a cubic inch. It has the same internal mechanism as a dry gas metre, and is a handsome specimen of their manufacturing skill.

Abstract of Meteorological Observations for May, 1859; made in Philadelphia, Somerset, Dauphin, and Centre Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

1859.	PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.									SOMERSET, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.						HARRISBURG, Dauphin Co. 40° 16′, N. 76° 15′, W. JOHN HEISELY, M D., Obs.				FLEMING, Centre Co. Lat. 40° 55′ N. 77° 53′ W. Ht. 786 ft. S. BRUGGER, Obs.		
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain.	Prevail'g winds	Bar.	Ther.	Relative humidity.	Force of vapor.	Rain.	Prevail'g winds	Bar.	Ther	Rain.	Prevail'g winds.	Ther.	Rain.	Prevailing Winds.
May.	Mean.	Mean daily range.	Mean.	Daily oscillation.	Mean daily range.	2 P. M.	2 P. M.			Mean.	Mean.	2 P. M.	2 P. M.			Mean.	Mean			Mean.		
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.	Direc.	Inch.	°	Per ct.	Inch.	Inch.	Direc.	Inch.	°	Inch.	Direc.	Inch.	Inch.	Direc.
1	29·960	·216	66·6	19	7·3	18	·121		N E.	27·724	58·0	46	·329		E.	29·876	63·3		S.	58·3		S E.
● 2	29·948	·663	65·0	33	8·3	42	·388		W.	27·748	61·7	42	·388		N.	29·879	65·0		S.	59·3		W.
3	30·066	·118	59·3	18	8·0	41	·273		N E.	27·864	64·0	46	·389		S E.	30·066	63·7		S E.	66 0		S E.
4	30·153	·096	57·7	28	3·6	30	·235		(var.)	27·865	62·3	45	·401		S E.	30,076	62 3		S.	67·3		S W.
5	30·099	·654	59·8	27	2·2	34	·265		S W.	27·851	65·3	45	·457		E N E.	30·022	64·3		S.	63·3		(var.)
6	29·949	·151	63·0	30	4·2	31	·303		S W.	27·753	67·0	52	546		N.	29·872	69·3		S.	66·7		W.
7	29·788	·161	70·5	27	7·5	40	·441		S W.	27·649	69·0	47	·503		S E.	29·703	75·3		S.	70·6		(var.)
8	29·653	·135	73·0	29	2·5	32	·383		S W.	27·525	70·0	46	·562		(var.)	29 554	76·3		S.	69·6		S W.
☽ 9	29·556	·697	74·5	25	2·2	40	·468		S W.	27·415	69·3	49	·557		(var.)	29·424	77·7		S.	76·6		(var.)
10	29·673	·117	51 8	5	22·7	80	·321	0·182	N E.	27 446	62·3	64	·495	0·032	(var)	29 587	57·7		E.	55·7	0·340	E.
11	29 842	·169	49·7	6	2·2	86	·322	0·008	N N E.	27·627	56·7	55	·336		E.	29·804	54·7		E.	57·0		E.
12	29·899	·657	57·5	18	7·8	72	·415		N E.	27·701	60·3	61	·448		S E.	29·862	64·3		S E.	62·0		(var)
13	29.891	·017	67·5	24	10·0	56	·504		(var.)	27·724	68·0	53	·596	0·130	N W.	29·809	72 0		S.	74 7		(var.)
14	29·922	·030	69 7	16	2·8	36	·317		N.	27·790	62·0	61	448		N.	29 888	70·3		N W.	65·6		N W.
15	30·011	·089	62·5	19	7·2	38	·285		N N E.	27·788	60·3	47	·395		(var.)	29·935	67·3		N.	58·3		N W.
○16	29 992	·083	56·6	21	6·5	27	·175		E S E.	27·644	56·7	49	·315	0·270	S S E.	29·890	63·6		S E.	66·7		S W.
17	29 742	·249	56·3	15	5·3	71	·382	0·074	S E.	27·416	60·3	71	·537		(var.)	29·618	58·7	0·100	E.	55·7	0·240	W.
18	29·716	·034	59·8	10	3 5	83	·478	0·118	E.	27·446	61·3	58	·475		S S E.	29·603	63·3	0·482	E.	61·3		S E.
19	29·701	·646	65·3	13	5·5	85	·621	0·615	E.	27·505	65·7	50	·499		E.	29·632	67·0		W.	69·3		(var.)
20	29·826	·125	66·5	16	1·2	75	·572	0·616	E N E.	27·627	66·3	64	·554		E.	29·751	71·7		S.	69·3		(var.)
21	29 735	·093	68·7	16	4·5	77	·691	0·611	(var)	27·535	70·7	53	·622	0·419	S W.	29·631	73·3	0·294	S E.	68·7	0·500	(var.)
22	29·678	·102	65·6	8	8.3	86	·462	0·197	S W.	27·546	55·7	57	·327		W.	29·589	60 6		W.	59·0		N W.
23	29·962	·250	65·2	22	7·2	36	·299		N W.	27 736	58·6	59	·442		?	29·878	66·7		W.	60·7		W.
☾ 24	30·063	·101	69·7	26	4 5	40	·304		S W.	27·796	63·7	51	·522		S E.	29·956	71·3		S.	68·0		S W.
25	30 045	·033	70·6	24	0·3	43	·429		S W.	27·866	68·7	51	·586		W.	29·956	73·7		S.	68·3		S E.
26	29·943	·103	72 6	26	2·0	36	·416		S W.	27·758	76·7	51	·636		W.	29·826	76·3		S.	68·7	0·190	S E.
27	29·719	·224	74·3	26	2·3	41	·492	0·436	S W.	27·548	64·7	59	·497	0·112	W.	29·572	77·3	0·462	S.	76·7	0·205	(var.)
28	29·745	·111	64·7	11	9·7	42	289		S W.	27·607	54·0	61	·341		W.	29·656	62·3		N W.	56·7		N W.
29	29·820	·075	71·7	29	0·6	26	·265		S W.	27·660	62·6	52	·448	0·281	(var.)	29·720	68·3		W.	62·7		N W.
30	29·972	·152	70·2	16	5·5	53	·513		S E.	27·794	67·3	59	·649		W S W.	29·902	72·0		W.	65·7	0·254	(var.)
31	30·042	·077	67·5	12	5·6	52	·366	0 095	S E.	27·754	66·6	88	·473	0·412	S E.	29.918	66·3	0·666	S E.	60·0	1·500	E.
Means	29·874	·111	64 6	26	5·7	56	·383	1·946	87½ w.	27·664	63 3	55	·477	1·656		29 787	67·9	1 398		64·0	3·229	

JOURNAL

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OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1859.

CIVIL ENGINEERING.

Improvements in the Hanging and Arranging of Cylindrical, Conical, or Spiral Steel Railroad Springs for Railway Carriages,—being a Communication.—Patented by WILLIAM EDWARD NEWTON, London, October 19th, 1858.*

This invention consists in arranging cylindrical, conical, or spiral steel railroad carriage springs in groups or series of four or more springs, placed in double lines vertically, so as to possess the length of elastic action which two series of the springs would have if placed the one above the other, while the space which they occupy vertically is very much less than they would require if the springs were placed in pairs, one above the other.

Figure 1 shows, in side elevation, a group of four springs, with the stirrup or suspension-bracket by which they are suspended, and the top plates or caps in which they are set; and figure 2 shows, in side elevation, the manner of arranging and hanging the springs, in series or lines, between the forward and after pedestals of the truck of the car.

The springs represented are Gardiner's conically coiled steel springs, having an open central space or vertical axis; and the suspension-brackets or bars are adapted particularly to their use, but will answer for any other cylindrical spring.

In fig. 1, s, s', are the two lower springs, placed small end downwards, and side by side, their upper edges being parallel with each other. Upon the upper edge or periphery of the spring s, is placed

* From Newton's London Journal, July, 1859.

the suspension-bracket b, having its cup or cap to fit the head of the spring; it extends downwards by the side of the spring s, to b',—that is to say, about three-fourths the length of the spring s,—when it is bent at right angles, and is continued in a horizontal direction b'', (the length of the largest diameter of the spring,) to form a base for suspending the spring c; the bracket then turns vertically upwards, as at b''', until it reaches the top of the spring s', when it again becomes horizontal, so as to cover with its cap the head of the spring s'. After covering the head of the spring s', it is again bent downward to a point parallel with b'', when it is again bent in a horizontal direction, to form a base for sustaining the spring c', as shown by the dotted lines, which indicate the continuation of the spring c'; the bracket b, b', b'', b''', is then turned upwards, and becomes again connected with b, at the cup or cap of the spring s. The two pairs of springs thus arranged stand each in the angle made by the other, so that their caps are diagonal, and at right angles to each other. The two lower springs s, s', are carried by a plate a, on the lower beam, and in order to hold them securely in place, they stand on conical studs or short vertical pins. The lower horizontal part of the bracket at b'', should just be so far above the supporting bar a, as to allow the springs s, s', full play, that is, to shut down upon the spiral coils; and at the same time, the cap of the two springs c, c', should be so far above the plate that crowns the springs s, s', as to allow in like manner the spirals of c, c', to shut down upon

Fig. 1.

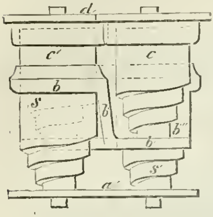
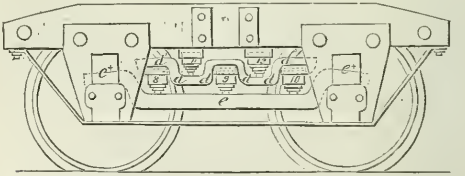


Fig. 2.



each other, so that, by this means, the whole length of elastic leverage of the two springs c, s, is attained, while the vertical space which they would occupy if placed one directly over the other, is reduced about three-quarters of the height of one of the springs. As a guard or shield to the springs, a thin iron disc of boiler plate iron is placed upon the head of each spring, between which disc and the under surface of the crowning cap is placed thick felting; the cap is flanched to receive the head of the spring and disc upon it, as into an inverted cup, by which means the springs are held in place at the crowns or top; the upper crown plate is firmly secured to the proper appendage under the car, for swinging the car upon the springs.

Another mode of carrying out the same principle of double tiers of springs within a greatly reduced vertical space, is by placing four or more springs in a series or line upon two grouping lever bars, one above the other, between the pedestals and the ends of the bars, having their bearings in the pedestals, as shown at fig. 2, in position under the car at *d* and *e*. The lower lever bar *e*, is horizontal and straight, except at the ends, where it is bent obliquely upwards, and again horizontally, so as to enter the pedestals at each end, and rest upon the top plate of the journal box, as at *e**, *e**. It is secured in its place by being let into a recess, or by a projection upon its under side, and a corresponding recess in the pedestal to receive the projection. Upon the upper surface of the bar *e*, are three vertical conical studs, upon and over which studs are placed the springs 8, 9, 10, in a straight line, and under the side timbers of the truck of the car; this bar *e*, should be a little thicker at the bent parts, to give it strength, as shown. Directly above the bar *e*, is hung the other lever bar *d*, bent alternately up and down; its upper parts resting upon the caps of the springs 8, 9, 10, and its lower parts forming a support for the two upper springs, 11 and 12, of the group which are placed over vertical conical studs on the bar. The crowns or caps of the upper springs 11, 12, face the under surface of the side timber of the truck or car, upon cup castings and discs, which rest upon the springs on either side. The last-mentioned bar *d*, has its ends jut within the arms of the pedestals, where it is held so as to have no lateral motion, and so as to permit the required play within the pedestal up and down; the ends of the bar being spread to very nearly the space between the arms of the pedestal, to avoid lateral motion.

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*On the Relative Values of Coke and Coal in Locomotive Engines.**

By Benjamin Fothergill.

(Continued from page 95.)

There yet remains the question of the durability of the fire-boxes and tubes when coal is used instead of coke, and I do not think that I could offer a better proof of the superiority of coal over coke in this respect also, than by quoting a portion of a report which I made on this important subject on the 26th of May, 1858, to the Locomotive Superintendent of the Manchester, Sheffield, and Lincolnshire Railway. The engines there referred to were built in accordance with Mr. Beattie's patent for burning coal and coke:—

"With respect to the durability of the tubes and fire-boxes, when coal is used instead of coke, I consider that question to be settled beyond dispute in favor of the former, inasmuch as it no longer remains a matter of opinion merely, but the result of continuous working with coal and coke demonstrates beyond all doubt that not only is coal superior to coke in respect to heating power, and consequently decidedly

* From the Jour. of the Society of Arts, No. 339.

more economical, but it is less injurious to both the tubes and fire-boxes of locomotive engines; as a proof of this I beg to append a copy of a tabular statement which I had the honor of laying before the directors of the London and South Western Railway in the month of March, 1856, showing the average duration of a set of tubes in their locomotive engines when coke alone was used. At that time as well as in the latter part of 1855, after I had made a series of experiments with coke and coal, I came to the conclusion that the tubes and fire-boxes would sustain less injury by the use of coal than coke, and although one of their coal engines had then run but 51,300 miles and no really appreciable depreciation had taken place in either fire-box or tubes, I saw sufficient to warrant me in concluding that the life of a set of tubes, as well as that of the fire-box, would be considerably prolonged by the use of coal instead of coke. Time has proved that the opinion I then formed was a correct one, inasmuch as I have, up to the present moment, carefully watched the effects produced on the fire-boxes and tubes of the locomotive engines on the London and South-Western Railway; and taking two of their engines which I have examined, where even part coke and part coal have been used up to the commencement of the present month, you will perceive the amazing difference in favor of coal when you compare the results with the tabulated statement copied from my printed Report, dated March 25th, 1856.

Miles Run by the Undermentioned Coke Engines, with One Set of Tubes, on the London and South Western Railway.

Working Pressure of Steam.	Name of Engine.	Miles run.
100 pounds, .	Volcano, .	118,978
100 " . .	Stromboli, . .	127,855
100 " .	Vulcan, .	128,947
100 " . .	Milo, . .	104,627
100 " .	Etna, . .	105,985
90 " . .	Ruby, . .	101,905
90 " .	Serpent, .	92,048
80 " . .	Medusa, . .	106,590
100 " .	Windsor, .	99,907
100 " . .	Mercury, . .	73,100
80 " .	Fire King, .	102,258
80 " . .	Mazeppa, . .	89,059
100 " .	Sussex, .	99,624
100 " . .	Mars, . .	103,257
100 " .	Comet, .	97,201
80 " . .	Hawk, . .	74,955
80 " .	Acheron, .	87,759
100 " . .	Test, . .	76,182
100 " .	Stour, . .	69,688
100 " . .	Rocklia, . .	86,469
100 " .	Avon, . .	78,785
100 " . .	Trent, . .	65,634
100 " .	Frome, .	83,108

Average duration of tubes, 94,518 miles.

"From the above table you will perceive the average duration of a set of tubes was 94,518, whilst in the two engines I have referred to,

where coal and coke have been used, one of them has run 154,955 miles, and is now carrying 120 pounds pressure of steam, none of the tubes having failed, and they are still in good working condition, and I am unable to say how much longer they will last. The other engine has run 137,676 miles, and I have had two of her tubes sent to my office in Queen's Chambers, Manchester, which you can see at any time.

"I personally paid a visit to the works at Nine Elms and examined these engines; and, bear in mind, that although a portion of the fuel used in these engines is coke, yet the tubes I now refer to have only worn to the extent of three wire gauges in thickness; they were ordered and made to No. 13 wire gauge, and are now No. 16 wire gauge.

"No doubt exists in my mind that the principal portion of this amount of reduction in thickness is attributable to the cutting action of the coke, and not to the effect of any deterioration produced by the action of the coal. With regard to the effect on the fire-box of the latter engine, the back, sides, and crown, are $\frac{1}{32}$ of an inch less than their original thickness, namely, $\frac{1}{2}$ an inch; the tube-plate has been reduced $\frac{1}{16}$ of an inch, the origiual thickness being $\frac{3}{4}$ of an inch. From these facts you will be able to draw your own conclusions—they speak for themselves—for in one case, where coke alone was used, you have an average (taken from the Company's books) of 94,518 miles as the life of a set of tubes, whilst in the other, where coke and coal are used on the same railway, and working similar trains, you have 154,955 miles run in the one case, and 137,676 miles in the other, and the tubes still in good working condition.

"I have given you these facts as a sample of the results when coke and coal are used, because the fuel you are using in your engines is of a similar character; but I am prepared to prove that were your engines constructed to burn coal alone, the fire-boxes and tubes would be protected from the cutting action of the coke, and greater durability, much beyond the mileage I have reported for coke and coal, would be the result. I am not ignorant respecting the argument that some persons have advanced as to coal containing a greater amount of sulphur than coke; this is a fallacy which I have had proved beyond doubt, and therefore I hesitate not to give you a strong opinion in favor of coal, for instead of its proving destructive to fire-boxes, tubes, or smoke-boxes, the result of my observations and experiments proves the contrary."

In further confirmation of the increased durability of the tubes, I beg to state that the mileage of another engine of the same class as the two referred to, and burning a mixture of coke and coal, amounts to 181,589 miles, and the tubes are still in good condition, and working at a pressure of 120 pounds to the square inch.

In conclusion I beg to remark, that previously to the year 1853, several attempts had been made by different individuals to introduce coal as a substitute for coke in locomotive engines, but from various causes they did not persevere in developing its true commercial value, and I would take this opportunity of stating that the credit of this

important saving in railway expenditure is due to the skill and persevering industry of Mr. Joseph Beattie.

Summary of Experimental Trips made on the London and South Western Railway.

DATE.	Name of Engine.	Description.	Average time in hours and minutes.	Average speed in miles per hour.	Average feet consumed in pounds per mile.	Coal reduced to its coke value.	Quantity of water evaporated per mile in lbs. for 1 lb of fuel.	Highest temperature of water in tender during each trip.	Lead in number of carriages.	Weight of train including engine and tender. Tons.	Cwt.	REMARKS.
1855. Nov. 15,	Ironsides,	Coal,	2·31	31·25	16·71	11·14	8·29	124°	12·2			Beautiful, clear, frosty day and calm.
" 16,	"	"	2·31	30·68	17·24	11·49	6·72	158°	10·6			Damp foggy day, rails greasy for fifty miles.
" 17,	"	"	2·39	29·71	19·02	12·68	7·07	164°	12·1			Clear day, with strong side wind in favor of down, and against up journey.
" 19,	Vesuvius,	Coke,	2·36	30·27	20·62		7·15	76°	12·1			Wet drizzling rain, with light wind on our back.
" 20,	"	"	2·26	35·23	20·62		7·78	74°	12·2			Rails rather greasy; wind against down journey.
" 22,	Frome,	"	2·27	32·14	20·97		7·62	91°	13·3			" "
" 23,	Canute,	Coal,	2·11	36·76	16·71	11·14	7·35	166°	9·3			Fine clear day, with light wind in favor of down journey.
" 30,	"	"	2·49	27·65	20·51	13·67	8·26	142°	19·0	170	8	Fine frosty day; rails greasy for first 50 miles.
" 30,	Vesuvius,	Coke,	2·56	26·54	23·82		8·21	54°	19·0	167	12	This was the first trip with equal loads.
Dec. 1,	Canute,	Coal,	2·39	29·16	20·22	13·48	8·07	180°	19·0	170	8	Great difficulty in starting. Rails slippery in consequence of frost and damp fog; wind rather stiff against us.
" 1,	Vesuvius,	Coke,	2·47	27·92	24·92		7·78	54°	19·0	167	12	
" 19,	Canute,	Coal,	2·55	26·92	29·80	19·86	9·05		28·0	235	13	Frosty, with strong head wind against us.
" 19,	Vesuvius,	Coke,	3·09	24·71	30·16		7·13	36°	22·0	189	6	Water pipe in Canute gave way. Shut off heating apparatus.

Discussion.—The Secretary read the following communication, received from

Mr. D. K. Clarke, who says—I perfectly agree with Mr. Fothergill in assigning to Mr. Beattie the honorable position of pioneer in the successful practical introduction of coal as a substitute for coke in locomotive engines, as there can be no question that, by his persevering efforts, he first succeeded in fairly arousing public attention to the real magnitude and importance of the economy in working expenses in railways that might be effected by the general use of coal as fuel. I believe that from this source of economy alone an addition of nearly 1 per cent. may be made to the dividends on the original share capital of railways, taking one with the other, with the reduced tear and wear of locomotives so ably pointed out by Mr. Fothergill. I think, however, that the mode adopted in the paper, of illustrating the saving in cost effected by the substitution of coal for coke is open to criticism, and does not place the question on its proper basis. It is true that the quantity of coke manufactured from a given weight of coal weighs only two-thirds of the orignal coal so consumed, and that 1½ tons of coking coal make only 1 ton of coke. But in seeking to establish this ratio of 3 to 2 as the measure of saving, that is, that the cost of fuel is reduced one-third in dispensing with the coking process, it is overlooked that coking coal, as coal, is not the proper fuel for locomotives, and that therefore the calculation of saving should be based, not upon the relative quantities of coking coal and of coke made from it, but upon the relative prices and efficiency of proper locomotive coal and coke. This ratio is necessarily very variable, as it is affected by cost of transport and other elements. For instance, on one metropolitan line, whilst coking coal costs 12s. 6d. per ton, and the coke made from it costs 18s. 6d., other coal, suitable for locomotive uses, costs as much as 15s. per ton. On another line, whilst the cost of coke is 23s. per ton, the coal suited for locomotives costs 20s. per ton, or only 13 per cent. less. Again, take the North Eastern Railway at Newcastle, the difference of the cost of coke at from 8s. to 11s., and locomotive coal, at 7s. per ton, is so inconsiderable as to scarcely make it worth while to use coal on that line. Notwithstanding such local approximations in cost, there can be no doubt of the economical importance of the question before the meeting. Again, in the comparison of the coal-burning engines with the coke-burning engines of the South Western Railway no allowance has been made for the benefit of heating the feed-water in the former, as against the use of cold water in the latter; whereas my own experience with Mr. Beattie's engine, the Canute, showed a most material increase in the consumption of coal when the feed-water was not heated. The following were the results I obtained from the engine with hot and cold water respectively :—

	Average train.	Coal consumed per mile.	Temperature of feed-water.
With heated water,	11 carriages,	17·4 lbs.	191 deg.
With cold water,	11 "	24·0 "	56 "

Showing an increase of 6·6 lbs. of coal per mile, by using the feed-water cold, as was done in the coke-burning trials recorded by Mr. Fothergill. The coke value would therefore be 16 lbs. per mile, and

not 11 or 12 lbs., as assumed in the paper, for comparison with the coke-burning engines. The large extra consumption of coal, by shutting off the heating apparatus, is no doubt greater in proportion than would be deducible from the known constituent heat of steam and water; but it is caused also by the less favorable working conditions of the engine involved in the use of cold water. I hope on another occasion, to bring the results of my own practice in coal-burning without smoke before the Society.

The CHAIRMAN said the paper they had heard was a very interesting one, and reduced itself to this:—Mr. Fothergill proposed to establish that which appeared to be a very simple proposition, namely, that the whole was greater than its part; in other words, that coal which contained all the elements of combustion and locomotive power was more effectual than the same coal when deprived of some of its elements and converted into coke. It was a most important subject. not only to railway companies, but also to the public at large, who must derive great advantages from the enormous saving in the expenditure for fuel, which Mr. Fothergill had pointed out, and his arguments appeared to have great plausibility. He (the Chairman) would now be happy to hear the opinions of gentlemen present, whom he knew to be well acquainted with the subject.

Mr. GRANTHAM had listened with great pleasure to Mr. Fothergill's paper, as treating of a subject of very great importance, not only in a scientific point of view, but also as affecting the dividends upon railway property. He must confess that his friend's paper had a little disappointed him upon one or two points, and if it should be agreed that some matters of importance had been omitted, he would call upon the Society to award a gentle punishment to Mr. Fothergill, by asking him to read a further paper upon the same subject. He would, in the first place, call Mr. Fothergill's attention to what he considered an important omission in his paper, he not having stated whether he employed the hot water apparatus in the coke-burning engines, as well as in those burning coal. Perhaps Mr. Fothergill would be good enough to enlighten them upon that subject. He would also ask him whether he had considered the question of the blast in the coke and coal-burning engines, as he was of opinion that a much greater heat would be found in the smoke-boxes of the latter than of the former, and less blast would therefore be required. That was an important point. Mr. Fothergill had stated that the wear and tear of the tubes of the boiler was very much less in the coal than in the coke-burning engines. That fully corresponded with his own experience; but there was another element to be considered, viz:, the first cost of this particular description of engine. There might be a question whether the first cost of the engine, which appeared to be an expensive one, did more than make up for the difference in the wear and tear under the two systems. He did not say this with a view to depreciate the statements made in the paper, for he was an ardent admirer of the use of coal in locomotives. There was also another very important question —viz: the heat of the gases in the smoke-box. He was afraid that railway engineers had overlooked this too much, and he feared also

that those who had made experiments upon the subject had made some mistakes. He had lately taken pains to make inquiries of some of the leading engineers as to the heat in the smoke-boxes of locomotives, and the answer he got generally was, that experiments had been tried, and that the temperature had been reduced as low as 300 deg. of heat; others had informed him that it was about 400 deg. of heat in the smoke-box. A curious experiment had been tried in his own neighborhood, where a thermometer had been let down into the smoke-box, the bulb of the mercury going into the box for some distance, and the scale being in sight of the engineer. When the engine was standing at the station the thermomter recorded 300 deg., but it had no sooner started than the thermometer fell to 150 deg. This gave rise to some speculation as to the cause of this wonderful phenomenon, and many theories would, perhaps, have been founded upon it; but the whole was easily explained by the fact that round the thermometer there was a space, so that when the engine was put in motion, and the blast came into operation, the cold air struck upon the bulb of the thermometer, and lowered the temperature of the mercury. He believed the temperature of the fire-box would be much affected by the use of coal, and he was sorry that Mr. Fothergill had not brought that subject forward as an element in his experiments. Within the last few weeks he had been called upon to try some experiments upon locomotive engines in connexion with a subject which he was happy to see illustrated by some specimens upon the table that evening, which he hoped would come before the Society at a future time in a more connected form. Referring to these specimens of spiral heat-diffusers, Mr. Grantham went on to explain that the glass tubes shown, represented the tubes of a boiler, and contained a spiral bar of metal. This was the invention in the first instance of Mr. Duncan, a gentleman of considerable scientific attainments, who took out a special patent for it. Their mutual friend, Mr. Charles Wye Williams, whose name was honorably known to the Society, without being aware of these experiments, was making others in the most accurate manner of his own upon the same subject, and on an extensive scale. Mr. Wye Williams' apparatus was also the subject of a patent; and as these patents clashed with each other, and there were points in each which the other party thought desirable to be retained, they amalgamated their interest, and the invention was now known under the designation of Duncan, Gwynne and C. Wye Williams' heat-diffusers. Mr. Grantham proceeded to detail the results of experiments made with the heat-diffusers as recorded by Gauntlett's pyrometer. The diffusers were placed in the tubes of the boiler, and he knew from experiment that they reduced the heat in the smoke-box prodigiously, probably 200 or 400 deg. The indication of the pyrometer with the heat-diffusers was 800 deg. in the smoke-box, and he believed it would have risen to 1000 or 1200 deg. if the heat-diffusers had not been in use. He had every reason to suppose that if coke had been used in the engine instead of coal, the heat in the smoke-box would have been less. If, therefore, Mr. Beattie's or any other coal-burning engine had this enormous temperature in the smoke-box, it was evident that there was room for improve-

ment in that respect, and it was another item in favor of coal if these deductions were correct. He would state in passing that the heat-diffusers above alluded to, promised very good results, the first trials showing nearly 20 per cent. of gain, and one of the practical difficulties in using them, viz: the supposed tendency in the tubes to become closed with ashes, had not taken place. Looking at the title of the paper, he regretted that Mr. Fothergill had confined his observations to one system only, as he was aware that he had an abundant store of information upon the burning of coal under other circumstances. He did not say this to detract in any way from the merits of Mr. Beattie's improvements. That gentleman had courageously faced the question, and was the first to direct public attention to it. He (Mr. Grantham) had, however, great hopes that some simpler means than those introduced by Mr. Beattie would be adopted. For a great many years he (Mr. Grantham) had attended the experiments of Mr. Wye Williams, and had been a party to most of the investigations made by that gentleman upon the combustion of coal, and from the experience thus derived he was of opinion that the operations so necessary in this matter would be carried on by a simpler engine than that of Mr. Beattie—combining, it might be, many of his contrivances, but doing away with a great deal that was complex.

(To be Continued.)

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*On the Co-efficients of Elasticity and Rupture in Wrought Iron, in relation to the volume of the metallic mass, its metallurgic treatment, and the axial direction of its constituent crystals.** By R. Mallet, M. Inst. C. E.

(Continued from Vol. xxxvii, page 397.)

Discussion.—It was explained that Tredgold and other experimenters only gave the absolute forces which would tear a bar asunder. In the present investigation an endeavor had been made to ascertain the amount of permanent elasticity possessed by the metal, as well as the point at which it would become actually ruptured.

It was contended that the drawings exhibited gave a very imperfect representation of the piling of the iron for large forgings, and that hence the author had been led to draw erroneous conclusions. With regard to the manufacture of the two monster mortars, 36 inches in diameter, and capable of throwing a ball weighing about 30 cwt., it was remarked that their merits as forgings were extraordinary. At first, owing to large rents in the centre of the core, the forgings were failures, but after a little experience had been gained, the second forgings were quite successful. In the manufacture of these monster guns they were built up in seven distinct layers, the forging occupying seven weeks. So far from any deterioration or crystallization taking place, the metal was improved by its long-continued heating and working; and the metal in the heart of the gun was found to be of greater strength than the bar iron of which it was composed, being perfectly homogeneous, strong, and tough. A series of experiments for testing

* From the London Civ. Eng. and Arch. Jour., April, 1859.

the correctness of the process showed that the ordinary manufacture of bar iron, by working and re-working several times, had its limits. As a proof that the deductions in the Paper were incorrect, it was asserted that engineers had one universal rule for the manufacture of forgings, whether large or small, and it was not found that the shafts of 1000 H. P. engines were more liable to fracture than those of 100 H. P. This was practical evidence that the metal was not more deteriorated in large forgings than in small from the length of time it was exposed to the action of the fire; indeed no one portion was so exposed for any great length of time. It was urged that scrap iron, or any other highly refined iron, was the worst material for the construction of large forgings. It was considered that a strong, fibrous, fresh-puddled iron was superior in every respect, as the ordinary workings required in the process of forging would be sufficient to improve it to the average maximum of strength; whereas, a highly refined iron had already reached the highest point as regarded strength, so that it was more likely to be injured by additional working. There was another reason why scrap iron should not be used for the manufacture of forgings. Scrap iron was composed of many different qualities of iron, all having their own special welding points. When worked together, one portion which was less refined was too much heated, and consequently deteriorated before the more highly refined portions were at a welding heat; so that there was the difficulty either of burning the one, or of being unable to weld the other. Again, the specimens selected by the author for trial, and which he said were weaker than the original iron composing the forging, were not taken off in the direction in which the fibre was laid for strength—in which it was intended that the strain should be borne. Now, forge masters always laid the grain of the metal in the direction in which the strain would ultimately be applied; whereas the samples experimented upon, had been cut transversely to that direction.

With regard to the new material, "puddled steel," it was believed that it was destined to work a complete revolution in almost all matters in which iron had hitherto been used. It had been proved to possess at least double the tensile strength of the best wrought iron, and the elastic limit of the material was also greater in proportion to the breaking strain. A piece of this material had been subjected to a strain of 32 tons per square inch for seventeen consecutive hours without exhibiting the slightest appearance of elongation. Subsequently, a bar 4 feet in length and 1 inch by $\frac{3}{16}$ths inch in section, had been exposed to a strain of 45 tons per square inch, when it was found that an elongation of $\frac{15}{20}$ths of an inch had taken place. Upon the weight being removed $\frac{13}{20}$ths of this elongation were recovered, showing that the elasticity of the material had not been destroyed. On another occasion the elongation amounted to $\frac{24}{100}$ths of an inch, and returned to $\frac{20}{100}$ths of an inch. Upon a second application of a strain of 56 tons per square inch the bar was broken, the elongation having been $\frac{37}{100}$ths of an inch. In other experiments the bars broke at 55, 56, and 60 tons, and one bore the enormous strain of 87 tons per square inch. To attain this favorable result, which it was believed might eventually

be accomplished as a rule, it was essential that great care should be taken in the selection of the materials, and great pains in the manufacture. It was entirely a question of good workmanship and good machinery; and a new manufacture of this sort would, for years to come, require the utmost attention and solicitude. In Germany, where this great improvement in metallurgy had been first introduced, a large number of manufacturers commenced making puddled steel; the consequence had been that an amount of bad material had been thrown upon the market, which had brought puddled steel into disrepute for a time, and from which it had scarcely yet recovered. This was to be feared in this country when the German patent had expired.

It was further contended, that if the calculations in the paper had been based upon forgings faggotted in the manner delineated in the drawings, they were of little practical utility. It was stated that large forgings weighing 20 tons, and measuring 24 inches in diameter, for engines of 1000 H. P., were now made at several places in England, without flaw or defect, except perhaps a small sand speck upon the surface, which was not of any consequence. When Nasmyth's hammer was first introduced, the plan was suggested of having the lower forge block made of a V shape, and the bottom part of the hammer so small as to strike only upon the upper centre of the periphery of the forged piece. The mass was thus struck in three places, and the tendency was to force the material to the centre, so as in fact to render the heart as solid and homogeneous as the other portions.

In reply to an inquiry as to whether the rents in large iron forgings, spoken of in the paper, would not also be liable to occur equally in the puddled steel, it was said, that in forgings of iron large crystals or grains were developed, which would not be the case in similar masses of puddled steel; and that in the latter the aggregation of grains or crystals was not increased by the agglomeration of the mass. These rents might be accounted for by the differential contraction of the metal. In the principal case referred to, the outside of the collar, which was 4 feet in diameter, cooled more quickly than the remainder of the forging, and these internal rents took place after it had left the hammerman's hand. It was stated that plates of puddled steel had already been supplied from the Mersey works for twenty-one vessels, some of them 250 tons burthen and 38 feet beam. The thickness of the plates for the vessels for Indian river navigation was one-eighth of an inch, and none had yet been made, or called for as a mercantile commodity, of greater thickness.

In conclusion, a hope was expressed that on an early occasion the subject of puddled steel would be again brought under the notice of the Institution; for, if it possessed the qualities ascribed to it, it was worthy of the most careful consideration of engineers, who had to design large railway structures, as well as for other purposes. In India and distant colonies, to which so much material had necessarily to be transported for public works, anything which would tend to reduce the weight to be carried, and consequently the freight, was a point of the highest importance. The Institution was therefore under great obligation to the author for having elicited this information.

AMERICAN PATENTS.

List of American Patents which issued from June 14, to July 5, 1859, (inclusive,) with Exemplifications.

JUNE 14.

93. Washing Machine; Pleasant Armstrong, Camden, Alabama.

Claim—1st, The arrangement of the complete stationary rounds of the convex swing frame, on two semicircular lines of different diameters, so that the rollers on the smallest semicircle shall stand above and opposite the spaces between the rollers on the largest semicircle, in combination with the arrangement of the stationary rounds of the concave. 2d, The arrangement of two auxiliary treadle standards with the main standards of the tub, in the manner described.

94. Machine for Printing Addresses, &c.; John A. Barrington, Fredericktown, Ohio.

Claim—1st, A cylinder, constructed with grooved pins, or their equivalents, for holding forms of type, presenting them at a proper point, to perform the office of printing, and afterwards allowing them to be delivered from the cylinder. 2d, In combination with the cylinder, I claim the ribs, arranged upon an endless chain in such manner as to receive the forms of type. 3d, Securing the forms within the ribs, in such manner as to present said forms properly for printing, by means of the follower, catch, and spring. 4th, Adjusting the forms of type for printing and delivering them from the cylinder after printing, by means of a reciprocating bar. 5th, The inclined feed wheel, constructed with adjustable spring conveyors, and operating as described. 6th, Regulating and adjusting the speed of the endless apron by means of the inclined disc, friction wheel, set-screws, and crank screw.

95. Gauge for Measuring the Pressure of Fluid; Victor Beaumont, City of New York.

Claim—1st, So arranging respectively dome-shaped elastic discs of one or more spring chambers in pressure gauges, as that the pressure of steam, or other fluid, within said chamber is indicated by the motion of the disc or plate, which presents its convexity to the pressure. 2d, The manner of guiding the free end of a spring, consisting of one or more chambers, expanding by pressure from within, in order to prevent it from vibrating in any direction but that of its axis. 3d, In pressure gauges with a hollow spring chamber mechanism, I claim partially filling the space inside of chambers with a solid substance or substances, in the manner set forth.

96. Instrument for Measuring the Strength of Watch Springs; J. M. Bottum, City of New York.

Claim—An arbor, having a measuring spring affixed thereto, together with an index, and an attachment for attaching the hair spring to be measured, arranged in the manner set forth, and constituting a ready means of determining the exact force of said hair springs.

97. Churn; P. S. Devlan, Reading, Pennsylvania.

Claim—The employment in a churn in which the cream is acted upon by a blast only of a float, as described.

98. Ore Separator; William O. Bourne, City of New York.

Claim—1st, A sieve-bed, in which the opening or openings for the passage of the air water through it, are so contracted as to enforce an uniform action of the air or water through the entire surface of the sieve-bed, which may be made of sheet metal, or of any textile material, either separately or in combination, or of their equivalent. 2d, The application of a vibrating and shaking motion to a sieve-bed, in combination with a blast or current of air or water, in the manner described. 3d, The described adjustable blades for agitating the substance on the sieve-bed, and for regulating the discharge of the refuse substances over the front edge of the table. 4th, The separation of metals, or other heavy substances, from ores, or other materials, when upon a sieve-bed, by the gravitation of the lighter substances towards and over the front or waste edge, when acted upon by a current of air or water through a sieve-bed, in the manner set forth.

99. Marine Hand Propeller; E. C. Brackett, Newton Corner, Massachusetts.

Claim—The arrangement and combination of the adjustable oar, arms, D, oscillating shaft, hinged blades, rods, arms, E P, rod, and lever, as described.

[A number of propellers or blades are hung to a pivoted arm which is fixed to the end of a vertical post attached to the side of the boat, and they are operated by means of an arm, connecting rod, and lever, so as to give to them a swinging or vibrating motion, at the same time the blades are so hinged as to adapt themselves to the impact of the water in an inclined position similar to the act of rowing or sculling.]

100. Valve; William Bramwell, City of New York.

Claim—The sliding nut actuated by the screw, in combination with the hinged valve and toggle links, as specified.

101. Reefing Sails; Joseph Francis Brouard, Havre de Grace, France; patented in France, Feb. 2, 1855.

Claim—1st, Supporting the rolling yard between its points of suspension by the hook, the said hook being constructed and operated for the purpose of staying the rolling yard and holding it in position when the sail attached to it is acted upon by the wind. 2d, The construction of the boom iron for the purpose of placing the boom in position to prevent the chafing of the sail, as described.

102. Projectile for Killing Whales; Robert Brown, New London, Connecticut.

Claim—The flukes on the shank of the bomb, the line attached thereto, the groove or indentation in the barrel of the bomb, for the line as stated.

103. Self-priming Locks; J. S. Butterfield and Simeon Marshall, Philadelphia, Pennsylvania.

Claim—1st, The extension on the carrier, in the manner set forth. 2d, Disconnecting each primer from the roll with the raising of the hammer, in the manner set forth. 3d, The adjustable centre projection and thumb-screw, arranged and operated in the manner set forth.

104. Method of Attaching the Capping of Fence Posts; R. S. Cadwell, Andover, Ohio.

Claim—The projection or tongue formed on the top of the post, in connexion with the mortise in the capping, for attaching the said capping to the post and securing it by a batten.

105. Mode of Fastening Letters to Signboards, &c.; Thomas Champion and Thomas Motley, Washington City, D. C.

Claim—The placing or casting on the back of letters projections with solid cast or wrought shanks therefrom. Also, holes in said projections to fasten by screws, nails, or rivets, as described.

106. Fly-trap; I. S. Clough, Brooklyn, New York, and S. R. Burrell, City of New York.

Claim—The combination of the stationary cone, revolving catcher, and start and receptacle, when constructed as described.

107. Sugar Cane Press; Thomas Crame, Port Atkinson, Wisconsin.

Claim—The combination of the pressure rollers with the main bearing wheel of a frame, which is so proportioned and supported that it can be rotated around a pivot post—but this I only claim when a fluid receiving vessel, conducting tube, an annular channel, and a delivery spout, are combined with the said frame, substantially in the manner described.

108. Manufacturing Paper; S. S. Crocker and George E. Marshall, Lawrence, Massachusetts.

Claim—1st, The combination of internally heated drying cylinders with a steam box or boxes, arranged for the purpose of continuously, first, thoroughly drying paper, and then superficially moistening it, by the direct application of steam prior to the operation of calendering. 2d, The combination of a steam box or boxes, so arranged as to moisten paper superficially by the steam therein contained, with rolls which calender by pressure, as described.

109. Looms; Charles Crossley, Ellington, Connecticut.

Claim—1st, The combination of the series of vibrating tuft-formers and the vibrating reed, arranged as described. 2d, The combination of the weights, the knotted cord, and slotted arm, for the purpose of controlling the set-off of the tufting yarn beam.

110. Drain Tile Machines; Jones Daines, Birmingham, Michigan.

Claim—1st, The bar, o, and hooks, in combination with the cross-bar, when used for the purpose of opening the lid automatically. 2d, The bar, e, combined with the frames, in the manner mentioned, with the levers, for cutting off the tile by the returning of the plunger.

111. Horse Bracket; T. B. Davis, Lexington, Massachusetts.

Claim—The improved mode of fastening and confining it to the foot, by having the points of attachment bear directly upon the shoe, so as not to injure the ankle or fetlock, by galling on the hoof by compression, and also the machinery by which the bracket is adjusted to the size of the foot, and held more firmly and securely than by any other mode of attachment now known.

112. Milk Can; E. R. Denniston, Middletown, New York.

Claim—A milk can, having its cover hinged to a flanch and provided with a plate and stopper, and having the guard hoop attached to the body of the can.

113. Ploughs; Eli Moore, Slabtown, South Carolina.

Claim—The arrangement of the beam, brace, clevis, foot, stock, and ring, constructed as described.

114. Attachments to Locomotive Engines for Removing Objects from the Track; C. H. Eisenbrandt, Baltimore, Maryland.

Claim—The double suspension lifting platform, composed of the parts, the yielding network or flexible fender guard, or its equivalent, when arranged in the manner described.

115. Operating Switches on Railroads; Charles Foster, Eldridge's Hill, New Jersey.

Claim—The mode of operating switches by means of movable cams, or their equivalents, on the car, acting on a cam, or its equivalent, connected by means of levers with the switch rail.

116. Machines for Dressing Millstones; H. B. Gill, Ogden, New York.

Claim—The combination and arrangement of the pivoted segmental arm and slide with the striking lever and cam, or its equivalent, in the manner set forth.

117. Machines for Making Hay; T. I. Goff, Warren, Rhode Island.

Claim—The combination of the gathering rake and revolving rake, when arranged for joint operation, as set forth.

118. Ventilators; G. D. Greenleaf, Chateaugay, New York.

Claim—In combination with the cylinder, bell-shaped casting, and plates, the cup and register, for the purpose specified.

119. Rotary Engines; Dexter D. Hardy, Cincinnati, Ohio.

Claim—1st, The arrangement of the rings, operating in the described combination with the pipes to pack the revolving shaft in its connexion with the stationary cylinder, by the use of steam or water pressure. 2d, The combination and arrangement of the revolving shaft containing the receiving and discharge ports with the stationary cylinder and valves.

120. Horse Rakes; Henry Hersh, Lancaster, Pennsylvania.

Claim—The arrangement and combination of the S-shaped teeth, lock, revolving axle, and clearers, as described.

121. Omnibus Registers; H. C. Howells, City of New York, and J. C. Howells, Madison, Wisconsin.

Claim—1st, The employment of a yielding platform to determine the value of the entry or fare, and in combination with doors, or equivalent devices, to secure the registration of persons standing upon it, previous to their ingress or egress. 2d, The employment and use of the circular or segmental doors, or equivalent devices, having within the area of their action a yielding platform, operating as set forth. 3d, In combination with the yielding platform, an operative lever, and vertical rod, and puppet, or their equivalents. 4th, The pin or bolt, in combination with the arm attached to the vertical rod, or their equivalents, for communicating motion to the registering levers by the action of the jointed arm, as specified. 5th, The registering levers, operated as set forth, or their equivalents, and in combination with the registering ratchet wheels and the spring pawls, together with the double dial for registering the whole or half entries or fares. 6th, The stationary brushes, and the arrangement and combination of levers and rods, or their equivalents, for operating the doors and steps, as set forth.

122. Sowing Machines; Solon P. Hubbell, Unadilla, New York.

Claim—The combination of the bar having teeth, angular notches, and clearers, with hopper, its pins,

and slide blocks, arranged as set forth. Also, in combination with the hopper, pins, slide blocks, and regulating plate, the reciprocating bar, with its clearers and stirrers, arranged in the manner described.

123. TUNING KEY-BOARD; Richard Humphreys, Jonesborough, Tennessee.

Claim—The described compound tuning reeds, necessary to represent the corresponding keys in the general scale of musical notations.

[The nature of this invention is in combining on a rectangular board, any desired number of octaves of properly tuned reeds similar to those used in melodeons, to represent a corresponding number of octaves of the natural scale of musical notation (or white keys of a piano-forte), and another set of correctly tuned reeds to represent the semi-tones of the octaves in such a manner as to enable the musician, by comparing the tones of his instrument with those of the key-board, to detect and correct the least departure from the correct tone.]

124. WOOD SCREWS; Henry L. Kendall, Providence, Rhode Island.

Claim—A wood screw, having a thread of a ratchet tooth-shape, in combination with wide spaces between the convolutions thereof, on a stem cylindrical, or nearly so, and on a point of any suitable form. Also, making the threaded point of a wood screw in such a manner that the thread thereof (except the terminal convolution,) shall be of the same, or nearly the same, depth on its upper and lower sides, to give the screw a firmer hold of the wood, especially on its first entrance, than it would have if the threads on the point were made of gradually less depth toward the apex. Also, so forming the thread of a wood screw that it shall be of the same depth on the upper and under side, on the point and on the stem, (except the terminal convolution of the point, which is contracted rapidly in depth and width.)

125. BREECH-LOADING FIRE ARM; Daniel Leavitt, Chicopee, Massachusetts.

Claim—Effecting the locking and unlocking of the upwardly opening breech, and the starting of the same from its seat to open it, by means of a detached lever having a locking dog to enter a notch in the breech, and a toe to act against the bottom of the breech, as described.

[This invention consists in the employment, in combination with a breech-loading fire arm, of what the inventor calls a "combination packing," consisting of a piece of felt fitting snugly into the rear portion of the barrel, and a piece of stout paper, pasteboard, or other hard, inflexible material, of a form and size to pass easily through the barrel, the felt being placed next the breech of the fire arm, and the paper or hard material between the felt and the charge, that by the force of the explosion it may be driven back against the felt, and so caused to compress the same against the breech and spread it laterally against the sides of the chamber, and force it close against the joint, and so prevent the escape of gases and keep the joint perfectly clean. This "combination packing" is applicable to breech-loading fire arms of various constructions.]

126. SEWING MACHINES; James S. McCurdy, Brooklyn, New York.

Claim—1st, The combination of a reciprocating needle with a pair of loopers, or their equivalent, the combination as a whole operating in such manner that each successive needle loop is encircled by a tight coil of the thread of the preceding loop. 2d, The combination and arrangement of two loopers with a driver, operating in the manner described. 3d, Constructing and operating one of the loopers in such manner that a supplementary movement is imparted to it while the other is at rest, for the purpose of tightening the stitch.

127. MUSICAL INSTRUMENTS; H. T. Merrill, Galena, Illinois.

Claim—The gamut board, applied above and behind the keys, in combination with a sliding name-board, or its equivalent.

[The object of this invention is to facilitate the learning of the location of the notes and their indicative letters upon the base and treble staffs, and at the same time the association of the location of every note upon the staffs with its respective key on the key-board of a piano-forte, melodeon, organ, or other musical instrument having a key-board of a similar character. To effect this, a vertically sliding name-board, or board occupying the usual position of the name-board of a piano-forte, or similarly keyed instrument, extending the whole length of the key-board, a fixed or "staff-board," having represented on it the base and treble staffs, and the indicating letters of the notes arranged above their respective keys, are employed, the "staff-board" being so arranged behind the name-board as to be exposed by sliding up and concealed by sliding down the last-mentioned board.]

128. CULTIVATORS; Azel Smith, Westfield, Ohio.

Claim—The adjustable brace plates, frames, and cutters, when arranged as described, and in combination with the adjustable mould-boards.

129. LAMPS; Rufus S. Merrill, Lynn, Massachusetts.

Claim—In coal oil burners of otherwise ordinary construction, the combination with a flat wick tube of the removable director, constructed with inclined side walls and vertical ends, the latter being corrugated or grooved to fit the ends of the wick tube, as a means of securing the director to the wick tube, and for directing or conveying the heated vapors, mixed with atmospheric air, to the sides of the flame.

130. HANGING CARRIAGE BODIES; Leman C. Miner, Hartford, Connecticut.

Claim—1st, The application of the double-jointed shackle to the front axle, whereby the vertical position of the spring and axle is sustained, and the fifth wheel and appendages dispensed with. 2d, The back axle braces with double joints to admit a free and easy vertical motion of the springs, and supporting the axle in its upright position.

131. VULCANIZING CAOUTCHOUC; Dubois D. Parmelee, City of New York.

Claim—The preparation and use of the ingredients described, with bromine, whether combined or not with sulphur, substantially as described.

132. STEAM PRESSURE REGULATOR; A. P. Pitkin, Hartford, Connecticut.

Claim—The forming a connexion with the reduced pressure pipe or chamber, A, and diaphragm spring or piston, or their equivalents, for the purpose of opening and closing a passage, C, between the high and reduced pressure pipes or chambers, A and D, as described. Also, the combination of passage, C, piston or valve, rod, lever, diaphragm spring or piston, and safety-valve, arranged to operate in relation to each other, as described.

133. DEVICES FOR SECURING THE CLEVIS TO PLOUGHS; R. B. Pringle, Coventry, New York.

Claim—The arrangement of the pin, feather or rib, spaces, clevis, beam, and groove, as described.

134. KEYS, &c., FOR PIANO-FORTES; Joseph Hoffacker and Joseph Richards, City of New York.

Claim—1st, The construction of the key-board, by substituting, instead of the usual keys, knobs connected with the main levers. 2d, The pivoted rod, in combination with the main levers. 3d, The construc-

tion of the damper, as set forth. 4th, The construction of the trigger and its action on the damper, as described. 5th, The construction of the hammer and its action, in combination with the principal lever, as described.

135. Clip for Carriage Thills; Daniel J. Riker, Harlem, New York.

Claim—Extending the plate of the carriage clip, in the form of a spring, to the eye of the shafts, and causing said spring to operate on the aforesaid eye, in the direction of the pull, to keep the parts of the bolt and eye in contact.

136. Speeder and Stretcher Flyers; John N. Sawtell, Chicopee, Massachusetts.

Claim—A flyer for spinning frames, when constructed essentially in the manner and for the purposes set forth.

137. Method of Ventilating Corn Houses; Noah Seitz, Mellmore, Ohio.

Claim—The arrangement of the openings with the wire grating, in combination with the secondary perforated floor, lathing, and ventilator, as set forth.

138. Saw-set; Alex. Shoemaker, Carey, Assignor to James G. Hunt, Reading, Ohio.

Claim—The adjustable arm with the fingers and adjusting screw, in combination with the spring trip-hammer. Also, the spring and the trip-hammer, in combination with the adjusting frame, and rollers, and adjusting screws, when arranged as set forth.

139. Constructing Sheet Metal Coffins; Isaac C. Shuler, Amsterdam, New York.

Claim—1st, The arrangement of strengthening the lower part of a sheet metal coffin, by folding over and soldering together, consecutively in several thicknesses, the surplus metal of the sides and ends of a sheet metal tray, forming a rim all round the outside circumference of the base, and fastening the walls of the coffin firmly thereto. Also, the arrangement of fastening to the under side of this tray or bottom of the coffin, the frames, for the purpose of stiffening it. 2d, The arrangement of placing on the inside of a sheet metal coffin a metal tray, with scrolled edges, which rests on a flanch formed by turning in the walls of the coffin all round their lower edges, and fastening this train firmly thereto, and also to the walls, for the purpose of strengthening the structure. Also, the bars for strengthening this tray. 3d, The arrangement of scrolling or folding outwardly, and soldering, consecutively, each fold of the surplus edges of the walls of a sheet metal coffin, forming a rim all round the upper edge of the walls, for the purpose of strengthening and securing the same in straight lines for jointing. 4th, The arrangement of forming on the inside of the upper edges of the walls of a sheet metal coffin, a scrolled rim on the piece, for the purpose of more firmly supporting the air-tight cover, and also for the purpose of securing the cover by screws as well as by solder when desirable. 5th, The arrangement of fastening on the outside of a sheet metal coffin, between the stiffening rims of the upper and lower edges of the walls, the studs or pillars at the corners and along the sides and ends in any required number, according to the size of the coffin, for the purpose of stiffening the sheet metal, in order that the structure may sustain a heavy weight. 6th, The arrangement of scrolling and soldering together the surplus edges of the air-tight cover of a sheet metal coffin, and beading the same, which, on being turned under, serves to fit the groove as well as to stiffen the cover. Also, the stiffening bars, as described. 7th, The arrangement of pressing a recess in the sheet metal all round the windows of a sheet metal coffin for receiving and supporting the glass. Also, the arrangement of supporting the glass by a flanch formed by the extension of a second inside sheet of the double cover. 8th, The arrangement of fastening the glass in these recesses, by means of metal sashes fastened to the coffin lid. 9th, The flanches formed on the outer edges of the sheet metal blinds, for the purpose of closing the metal sash, and securing the glass from the intrusion of dust, and from other annoyances. 10th, I am aware that I have claimed the bi-section of a hinged cover for the joint of the lid of a sheet metal coffin, according to the breaks in the side walls—I claim the cover, as applicable to a coffin with straight side walls in two hinged sections, as described.

140. Seeding Machines; Andrew Simmons, Nora, Illinois.

Claim—The arrangement of the boxes in relation to the agitator, plates, and in combination therewith, the hollow drill tooth, the several parts being so constructed as to form a broad-cast seed planter and drill.

141. Machines for Binding Grain in Bundles; James D. Osborn, Constantine, Michigan.

Claim—A binding knot composed of three loops passed through each other, when said passing of the loops through each other is effected by machinery driven or moved from any of the moving parts of a harvesting machine, and whether accomplished by the means herein stated, or by their substantial equivalents.

142. The Construction of Sled Runners; John M. Spooner, Springfield, Massachusetts.

Claim—Making both of the runners and the bearers of a sled or sleigh, or other similar vehicle, of one continuous piece or rod of steel or other metal, as set forth.

143. Seeding Machines; Enos Stimson, Plainfield, Vermont.

Claim—The arrangement and combination of the shaft, F, box, E, shaft, M, arm, O, and box, N, as described.

[This invention consists in a combination and arrangement of a broad-cast and drill and hill-distributing device, whereby two different kinds of seed may be sowed simultaneously—one broad-cast, the other in hills and drills, and either allowed to be used separately when desired.]

144. Breech-loading Fire Arms; Wm. Mount Storm, City of New York.

Claim—Such an arrangement of the links, as described, and their connexion with the breech piece and lever, that they shall jam forward and firmly hold the former against the rear of the bore of the barrel after it has ceased its motion transversely to the latter, and vice-versa, release the breech piece (in opening the breech) before its movement commences. Also, the perforated breech piece, in the manner described. Also, arranging the horn or head of the hammer, in the manner described.

145. The Running Gear of Sleds; R. Sutton, East Avon, New York.

Claim—The arrangement and combination of the sliding collar, rods, reach, sliding bolster, pendants, links, and runners, as described.

146. Stop-cock; Isaac C. Tate, New London, Connecticut.

Claim—The application of the spring, in the manner set forth, and for the purpose described.

147. Whiffletree Hooks; Lewis C. Terry, Chenango, New York.

Claim—A hook, pivoted or hinged to its supporting eye, which is cut away or flattened on its back, in the manner described, so that the point of the said hook, being in contact, or nearly so, with its said holding eye, will securely confine a link, a ring, a staple, a trace, or similar object, in all positions, excepting when turned

back upon the said flattened or eccentric part of the eye, as set forth. Also, the right, in addition to the above, to so construct the hook and eye that the hook shall have but one motion, viz: a horizontal motion directly around the circle formed by the said eye, so that the said hook shall not drop or work from side to side—and the exclusive right to use the same in either or both the forms above mentioned and described, for all purposes for which they may or can be used, when constructed as set forth.

148. CULTIVATORS; Joseph Thirlwell, Galesburg, Illinois.

Claim—The arrangement of the frame, the iron bows, the hinge bow, the tongue braces, and lifting chain, when constructed in combination for the purposes set forth.

149. SEEDING MACHINES; Franklin Veal, Hallettsville, Texas.

Claim—1st, The arrangement of the windlass, the hand lever, H, and the lever, N, in combination with the smoothing roller, the hopper, and the harrow, and in such relation to the driver's seat, that they can be operated from the same. 2d, The combination of the fan cylinder with the hopper, as described.

[The hopper box in this invention is arranged with a harrow and a smoothing roller in such a way that all of them, or each for itself, can be operated from the driver's seat, the hopper box being hinged and provided with a lever, whereby the box can be brought in such a position that the flap board or valve is not opened by the cam or that the same is opened for the purpose of discharging seed, and the harrow is suspended from a rope or chain in such a manner that the same can be lifted clear from the ground by means of a hand lever that can be reached from the driver's seat, and the smoothing roller is attached in such a way that it can be raised from, or lowered to, the ground by means of a windlass that is operated by a handle from the driver's seat.]

150. RAILROAD CAR COUPLINGS; David Warren, Gettysburgh, Pennsylvania.

Claim—The arrangement of the adjustable plate, as constructed with the pin, arm, rock shaft, and guards, when operated substantially in the manner set forth.

151. ROCK DRILLS; Lyman White, Davenport, Iowa.

Claim—1st, Placing the bearings of the shaft to which the box and drill carriage are attached in bar, which are fitted in annular parts of the supports, and arranged so as to admit of the facile adjustment of the drill to any angle or position required. 2d, The employment or use of the racks on the bars, in connexion with the wheels on the shaft, the screws attached to the sliding bearings by the bars, the wheels on the upper ends of the screws and the pins on the cranks, arranged as shown, to feed the drill to its work.

152. CAR COUPLINGS; Gilbert Yates, West Dresden, New York.

Claim—The combination of the chains and clasps with the bent and lifting rods, grooved parts and chains, arranged in relation to each other, in the manner set forth.

153. GRAIN-HULLING MACHINE; Wm. Zimmerman, Quincy, Illinois.

Claim—The conduits arranged to receive the grain scoured or operated upon by the first or each revolving scourer, when operated on a horizontal shaft, and conducted to the centre or central part of the second or next revolving scourer, and so on in succession through the whole series of scourers, until it passes out of the machine.

154. GRAIN BINS; Daniel D. Badger and W. S. Sampson, Assignor to Daniel D. Badger, City of New York.

Claim—The arrangement and combination of the metallic bins, in the manner described.

155. MACHINES FOR SHAPING THE BACKS OF BOOKS; John E. Coffin, Assignor to A. G. Gerrish, Portland, Me.

Claim—1st, The arrangement of the sliding holding jaws and the reciprocating roller carriage, as described. 2d, Combining the toggle mechanism which operates the clamping jaws, and the screw which operates the roller carriage with a cam and pulley, or its equivalent, on the same shaft, in such manner as to make a machine for shaping the backs of books, which is perfectly continuous and automatic in its operation, and to and from which the books only require to be introduced and removed by the attendant at the proper stage in its operation, as described.

156. MACHINE FOR CUTTING INDIA RUBBER INTO THREADS; Joseph W. Cox, Malden, Massachusetts, Assignor to Horace H. Day, City of New York.

Claim—1st, In combination with the concave rotary cutter, the employment of a tube placed in the concavity thereof, for the discharge of a jet of water against the cutting edge. 2d, The carriage with its divided clamps and follower, in combination with a rotary cutter, or any equivalent cutter, for the purpose set forth. 3d, And finally, in combination with the carriage clamp and follower, the mechanism, or any equivalent thereof, for operating the follower, as described.

157. MACHINE FOR BORING BLIND STILES; Daniel Dunham, Assignor to D. D. Sweet, James Bromily, and E. W. French, Pawtucket, Rhode Island.

Claim—1st, The rack, or its equivalent, in combination with the sliding carriage and with the dog, as described. 2d, The lever, arranged with the nose, in such relation to the treadle that by its action the dog is operated, as specified.

158. TRIP-HAMMERS; Bennet Hotchkiss, Assignor to self and F. S. Collins, New Haven, Connecticut.

Claim—My improved means of operating the hammer, that is, by an air spring cylinder, or its equivalent, applied to the piston and combined with mechanism, by which a rapid reciprocating rectilinear motion may be imparted to such cylinder, essentially in manner and so as to operate the piston and hammer, as specified. Also, in combination with the piston trip-hammer, the air spring cylinder and the mechanism for imparting to the latter reciprocating rectilinear motions, as described, mechanism for varying the altitude of the path of movement of the cylinder, under circumstances as explained, such mechanism as above described, consisting of an eccentric bearing shaft applied in boxes, and to the crank shaft of the cylinder.

159. COMPOSITION FOR CEMENTING IRON; Job Johnson, East Brooklyn, New York, Assignor to Charles D. Archibald, London, England.

Claim—The combination and use of lime, bone dust, and charcoal, in the manner and for the purposes described.

160. SPINNING TOPS; Francis Milward, Assignor to H. Homan, W. L. Thomas, and D. D. Hardy, Cincinnati, Ohio.

Claim—A combined gyroscope and spinning top, constructed in the manner set forth.

161. SEEDING MACHINES; Daniel Nichols, Assignor to Charles and Edward Rumley, Onarga, Illinois.

Claim—The combination and arrangement of hinged bars, slotted arc, driving wheels, and auxiliary seed hopper, when the same are arranged in the manner specified.

162. Rolling Metal for Jewelry; John S. Palmer, Assignor to self and Charles S. Capron, Providence, Rhode Island.

Claim—The employment of a tapering die, in combination with the pressure rollers, as specified.

163. Attachment for Alarm Clocks; E. T. Quimby, Assignor to self and Newton Brooks, New Ipswich, New Hampshire.

Claim—1st, The wheel, or its equivalent, having a series of projections, which, or some of which, can be covered up or removed, and operating in combination with the hammer, as described. 2d, The arrangement of the slides to operate in combination with the wheel and with the hammer, in the manner specified.

164. Corn Harvesters; George W. Richardson and James W. White, Grayville, Assignors to selves and George M. Weed, White County, Illinois.

Claim—The combination of the gathering wheels, terete rollers, stripping plates, and guide plates, as set forth. Also, the combination of the fender or guide plates, meeting the points of the rollers with the terete rollers and stripping plates, as set forth.

165. Water-wheel; Robert Ross, Assignor to self and George J. Stannard, St. Albans, Vermont.

Claim—The plate or gate placed within the water passages of the wheel, provided with the vertical projections at the issues, and attached to the rod within the shaft of the wheel, as set forth.

166. Railroad Cars; Henry Webb, Assignor to S. L. Wilder, Cincinnati, Ohio.

Claim—The angular rail, when constructed so as to be convertible and present a new surface after the first surface has been worn out, in the manner specified.

167. Means for Actuating Movable Parts of Fire Arms; Thomas Bailey, New Orleans, Louisiana; patented in England, December 3, 1858.

Claim—Combining a toothed wheel or pinion on a traveling centre, and working between guides with a pair of racks, one of which is stationary and the other movable, having connected to it the part of the fire arm to be moved, the toothed wheel changing its position or traveling in the same place with the guides.

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168. Instrument for Gauging Casks; John K. Barney, Warren, Rhode Island.

Claim—The calliper, the slides, the triangular calliper bracket and pins, and their combinations in the instrument, by which the true diameter at the bung of any cask can be obtained, however thick the sediment therein may be. I do not confine myself to the particular manner of fastening the parts in the instrument, but to the principles of the construction of the instrument.

169. Slide Valves for Steam Engines; R. C. Bristol, Chicago, Illinois.

Claim—The construction and arrangement of the partial rollers when sustained in their respective positions, in the manner set forth. Also, the described arrangement of the supported back-piece, loose face-piece, cut-off means, and the united passages, in the respective parts, A B, whereby the parts, A B, are allowed to work to a limited extent relatively to each other, without affecting the action of the steam, nor allowing an escape of the same through the joints. Also, in connexion with the above arrangement of the several parts, the described method of adjusting the parts, A B, relatively to each other, that is to say, working the parts, A B, for a period in a free relation, and then tightening the union by the set-screws, or their equivalents, until it becomes rigid, as described.

170. Sugar Mills; John Burge, Terre Haute, Indiana.

Claim—The combination and arrangement of one large and two or more small cylinders, with the strippers for stripping the leaves off the cane, and the scraper or separator for cleaning the cylinder and carrying off pressed cane, the whole constructed as described.

171. Double Seaming Machine; William Burton, Cazenova, New York.

Claim—1st, The use of a working head, in combination with a disc or "former," when arranged to produce an outward or eccentric draft, and at the same time accomplish the turning down of the double seam, as set forth. 2d, The working head, in combination with the shaft, which is adjustable up and down, and supports a tapper or straight-sided "former" or disc, and with the working head frame adjustable longitudinally, as set forth.

172. Boiler; O. S. Camp, Fairfield, Iowa.

Claim—A boiler made of double walls, and a single top and bottom, said top having flanches to fit against each wall, and the communication between the interior of the inner boiler and the space between the walls being made by closed passages, such as described.

173. Railway Chairs; Marion Carpenter, Cincinnati, Ohio.

Claim—The combination of the lugs with the base piece for sustaining the elastic cushion and its follower, in the manner set forth.

174. Sugar Mills; J. W. Chapman, Trinity Springs, Indiana.

Claim—The combination and arrangement of the forked lever crushing wheels, bearings and table or bed timber, the table being prepared with notches to receive the projections on the sect of the bearings and key-wedge, as set forth.

175. Shingle Machine; C. G. Conover, Jefferson, Wisconsin.

Claim—1st, The employment or use of the fence, in combination with a reciprocating splitting knife and reciprocating or shoving plate, arranged to operate as set forth. 2d, The reciprocating splitting knife, shoving plate, tapering knives, jointers, and clamp, combined and arranged to operate as specified. 3d, Operating the bolt carriage by means of the revolving arm on the shaft, and the obliquely toothed rack at the underside of the carriage, as described.

176. Straw Cutters; Reuben Daniels, Woodstock, Vermont.

Claim—1st, The combination with the roller of the convex teeth, having the major diameter of their bases arranged parallel with the axis of the roller, as described. 2d, The arrangement and combination of the roller, cutter, and cylinders, as described.

177. Hulling Clover; Nathaniel Eames, Hanover, Pennsylvania.

Claim—The combination of the screen with the cylinder, when said cylinder is provided with a spiral groove and a spiral strip of rubber, constructed in the manner specified.

178. CONVERTING RECIPROCATING INTO ALTERNATE CIRCULAR MOTION; Henry Ehrenfeld, City of New York.

Claim—1st, Arranging the lever and dog, in combination with the grooved wheel, or its equivalent, in such a manner that the dog acts on the wheel entirely independent from the centre or hub of the wheel, and that the lever can be brought in such a position as to impart motion to the wheel, in either direction, as specified. 2d, In combination with the lever, dog, and wheel, I claim the arrangement of the groove, or its equivalent, in the hub of the wheel, for the purpose of keeping the dog in the proper position, and to prevent the lever from tipping over sidewise, as specified.

179. CHEESE PRESSES; A. H. Emery, Mexico, New York.

Claim—The method of moving the follower upwards, by means of the weight, the cords, and the pulleys, arranged as described. Also, the arrangement of the arm, the ratchet, the pinion, the crank arm, together with the wheel, with the cogs either on the inside or outside, arranged as described.

180. SASH FASTENERS; A. H. Emery, Mexico, New York.

Claim—The construction of a window sash spring and fastener of drawn pipe, with the end, g, and the end, h, arranged and fastened therein, as described. Also, the construction of the knob-rod or bolt, as described.

181. ATTACHMENT OF HANDLES TO TIN PAILS; Thomas Evans, Watkins, New York.

Claim—Forming metallic ears for pails, buckets, and other vessels, with concentric angular corrugations surrounding the bail orifice, in combination with the flattened hook, the end of the bail, provided with an additional bearing against the surface of one or more of said corrugations, and the drop opening or downward continuation of the outer corrugation, in the manner described.

182. CORN PLANTERS; P. H. Freylinghousen and J. G. Hedman, Johnstown, Pennsylvania.

Claim—The perforated wheels, G, when hung to the sliding bars, and situated in respect to the hopper, and wheels, H, and otherwise arranged as set forth, so that on moving the said bars inwards, the wheels, G, may be drawn out of gear, and the orifices of the hopper at the same time closed by the wheels.

183. ROLL FOR FORMING TIRES; J. H. Gage, Nashua, New Hampshire.

Claim—The combination of the flanch, B, recess or depression, O, wide shoulder or tread, L, flanch, C, and short shoulder, D, with a series of thin metallic discs, said parts being constructed relatively to each other, in the manner set forth.

184. RETORTS FOR DISTILLING COAL OILS; H. P. Gengembre, Alleghany, Pennsylvania.

Claim—1st, The use of an L-shaped retort combined with charging boxes, crusher, and discharging tube, capable of being subjected to a degree of temperature at the end of the horizontal part at which the residuum of the substance under treatment is discharged higher than at the upright part at which the coal is charged, the whole so arranged as to avoid the admission of atmospheric air. 2d, The combination with my retort, constructed as described, of a crusher suited to the material to be distilled, placed within the retort at a point intermediate between the points where the heat is highest and lowest, for the purpose of breaking up the coal, or other substance, before the process of distillation is complete.

185. SEWING MACHINES; H. H. Goodwyn, New Orleans, Louisiana.

Claim—1st, The combination of the loosely fitted double conical sleeve with the soft leather or elastic backed and bearing eye, and a spring pressure, whereby the spool is brought to a proper centre, and the requisite tension produced, the cone sleeve revolving simultaneously with the spool and pivoted arm, and the friction or tension being obtained by the action of the outer end of the double cone against the elastic eye, in the manner described. 2d, The arrangement with the above of the peculiar spring pressure described, consisting of the pivoted or rocking standard, rod, spring, and rosette or nut, for operation together and with the spool, in the manner described. 3d, The attachment to the stationary shell or outer case of the tension arm, in the manner described. 4th, Hanging the bobbin on, and so as to rotate together with, a cylinder, when the same is combined with a spring inducing friction in the run of the bobbin, and operating in connexion with a tension arm or elbow acting on the thread from the bobbin, as described.

186. APPARATUS FOR HEATING BUILDINGS; S. F. Gold, Cornwall, Connecticut.

Claim—Constructing the generator of a series of similar cast metal sections, each complete in itself, and united substantially as described, so that the capacity of the generator will be governed by the number of sections used, and may be increased or diminished by adding or removing any desired number of the internal sections. Also, constructing these sections so that when united, there will exist the chambers rising above the water line and out of the draft of the furnace, as set forth. Further, in combination with the generator, the supplementary steam chambers made up of flat cast metal sections, as specified.

187. TANNING; Jacob Gove, Milford, New Hampshire.

Claim—Stirring the liquor or tanning fluid in the vat by means of a stirrer, constructed, arranged, and operated in the manner set forth.

188. MACHINE FOR CHAMFERING BARREL HEADS; John Greenwood, Rochester, New York.

Claim—The arrangement of the sliding frame, clamps, cam, lever, and gearing, in connexion with the circular dish-shaped saw and cutters, arranged for joint operation, as specified.

189. ELECTRO-MAGNETIC MACHINE; Thomas Hall, Boston, Massachusetts.

Claim—The combination of the spring connecting bar and the switch, placed between the machine and the battery, and operating with reference to each other, as described.

190. CONNECTING THE IRON GIRDERS OF BRIDGES; Joel T. Ham, Covington, Kentucky.

Claim—1st, Combining the posts and braces with the cords by means of the metal saddles, and the metal stirrups or straps, applied as described, whereby the expansion and contraction of the cords, posts, and braces, by changes of temperature, is provided for. 2d, The india rubber blocks or springs, applied between metal blocks, in combination with the saddles and stirrups, as set forth.

191. GUARD FINGERS FOR HARVESTERS; A. Hotchkiss, Sharon, Connecticut, and John P. Adriance, City of New York.

Claim—1st, The angular cavity for the free admission of the front end of the face plate to permit its shoulders, at the rear end, to be inserted, whereby the ends of said plate are firmly secured, in the manner specified. 2d, Confining the back end, c″, of the steel face plate, by bending down the metal of the finger upon the reversely beveled edges of c″, in the manner described.

192. TRACE FASTENER; Daniel H. Hull, Plantsville, Connecticut.

Claim—The combination and arrangement of metal plate, spring latch, spring, and knob, in the manner set forth.

193. Snow Ploughs for Railroads; W S. Huntington, Andrewsville, New York.

Claim—The employment or use of the plates or scrapers attached to arms of the shafts, which shafts have springs attached, and are connected to an adjusting bar by means of the arms and rods, the whole being applied to a car, and arranged to operate as set forth.

194. Tools for Fastening Bale Hoops; E. A. Jeffrey, Corning, New York.

Claim—1st, The employment or use of the combined pliers and die, arranged as set forth. 2d, The combination of the pliers and hammer with the pliers and die, arranged for joint operation, as described.

195. Chamfering Tool; Wm. Johnson, Jr., Hampstead, New Hampshire.

Claim—Supporting the knife and adjusting it with reference to the sole rest and the edge bearer, viz: by means of a carrier and adjusting screws, applied and arranged with respect to the sole rest, the edge bearer, and the presser, as described.

196. Apparatus for Cutting Teeth in Saws; K. H. Kinne, Mexico, New York.

Claim—The movable curved switch, in conjunction with the curved groove, for the purpose of adapting the machine to the cutting of teeth, on setting or sharpening the teeth of straight as well as circular saws. Also, operating and feeding the burr, by means of the shaft turning within the hollow screw shaft, when applied to a saw sharpener, in the manner described. Also, the bed-piece or anvil, for the purpose of supporting the saw teeth while being sharpened. Also, in combination with the burr and the anvil, the clamps for gauging and firmly holding the saw whilst being acted upon, as described.

197. Ship's Capstan; David Knowlton, Camden, Maine.

Claim—Fixing the shafts of the stud gears in a revolving plate arranged to turn with the barrel and head when they are locked together, and to be stationary when they are unlocked, in combination with two stud gears, by which the head and barrel are turned in the same direction when used as a geared or simple capstan.

198. Exhibition Rocket; Andrews Lanergan, Boston, Massachusetts.

Claim—Making the rocket with a match arranged and fixed in the choke, and protected or covered by a plane or thin disc, having no opening into the choke, nor any cavity or recess to hold the match or catch sparks. And I particularly claim attaching the match, as described, to the inner surface or side of the choke, or arranging the attachment therein, and with respect to the lower end of the match, the same not only enabling the match to be confined to the choke of the rocket, but to have a portion of it, after breakage of the cap, capable of being bent downward out of the choke into a convenient position for being fired.

199. Sled Brake; Albertus Larrowe, Cohocton, New York.

Claim—1st, Constructing the brake eyes in the peculiar form shown and described. 2d, The combination of the brake eyes with the brake, as described.

200. Whip and Line-holder for Guiding Horses without the use of the Hands; Lucius Leavenworth, Trumansburg, New York.

Claim—The arrangement of the rein-hooks or knobs which are united by one or more cross-bars or braces, and which are provided with a whip-socket, or without the same, in such a manner that a frame is formed, which, by the aid of suitable shoulder straps, or their equivalents, may be secured to the body of a person, as described.

201. Cork Machine; Harvey Locke, South Boston, Massachusetts.

Claim—1st, The employment or use of a reciprocating knife-stock, when provided with necessary knives, and arranged in combination with a rotating mandrel, traversing clamp, and feed-spout or trough, so that as the knife-stock moves back and forth pieces of cork will be cut from the bar or slab, and said pieces turned in suitable conical form. 2d, In connexion with the reciprocating knife-stock, attaching the mandrel and head to an adjustable bar fitted in the framing, and arranged so as to admit of the adjusting of the pieces of cork more or less obliquely with the knife, and vary the taper of the corks as may be desired. 3d, Placing the clamp in a reciprocating plate operated by the lever, Q, from the wheel, and the lever, R, from the reciprocating knife-stock, E, for the purpose of giving the traversing movement to said clamp to convey the pieces of cork from the jaws to the mandrel.

202. Wind-mills; James K. Lum, Skookumchuck, W. T.

Claim—The employment or use of the fly or frame placed on the arbor, and having the ends of the cord passing through it, and attached to said arbor, said cords being also attached to the rope of the weight, the fly being operated by the wind-wheel, in such manner as to admit of a simultaneous rotation of the arbor.

203. Grinding Mills; J. C. Lyons, Auburn, and Henry F. Phillips, Seneca Falls, New York.

Claim—1st, The arrangement and combination of the clasp, pin, screw, hand-wheel, and shaft, whereby the said shaft and grinding cone may be readily adjusted and firmly secured, whether the machine is in operation or at rest. 2d, The arrangement and combination of the double-flanched pulley, shaft, fork, rod, and shell, as described, so that by the adjustment of the shaft, the shell will also be adjusted.

[By the use of this mill grain may be ground finer or coarser, as desired, for the hub of the hand-wheel is provided with a screw, that is placed in such connexion with the grinding cone and corn-cracker that by turning the hand-wheel the shaft receives a longitudinal sliding motion that adjusts the cone to grind to any degree of fineness, and its free rotation is not interfered with.]

204. Potato Diggers; Perry Marcy, Tunkhannock, Pennsylvania.

Claim—The arrangement of the inclined smooth belt, tightening pulley, shield, ratchet wheel, levers, and bars, provided with teeth, constructed in the manner set forth.

205. Construction of Driving Shafts for Mills, Cotton Gins, &c.; James Massey, Thomasville, Georgia.

Claim—Suspending the driving shaft, in the manner described, to allow it to rise or fall with the floor, to which it is attached, operating substantially in the manner set forth.

206. Drainage Pipe; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—Combining with a stationary washing bowl sink, washing tub, or other similar articles, the elastic drainage pipe terminating in a wedge-shape, in the manner described.

207. Corn and Cane Harvesters; H. D. McGeorge and D. C. Greer, Morgantown, Virginia.

Claim—Providing a corn or cane harvester with a vertical reciprocating cutting apparatus, for the purpose of cutting the stalks into two or more pieces, in the manner described.

208. Machines for Sawing Stone; Andrews T. Merriman, Chicago, Illinois.

Claim—The lowering the saw frame by means of the long screws acting on the sliding bars, and the stiff

connecting rods hung with hinge joints at the saw frame, and the sliding bars (instead of chains or ropes), for the purpose of holding the saw frame steady and prevent any jumping motion.

209. WINDOW CURTAIN FIXTURE; Purches Miles, New Britain, Connecticut.

Claim—1st, The compound hanging bracket, capable of being raised up to permit the opening and closing of blinds, or for other purposes. 2d, Constructing and combining the parts, as described, so that the bracket can be attached to the top, side, or back of the window frame, and at either side of the window. 3d, Holding the band against a pulley having a friction surface by an arm or arms, as set forth.

210. CORRUGATING METALLIC SHEETS; Richard Montgomery, City of New York.

Claim—The waved corrugated wrought metal plate for boilers, in combination with the margins of greater thickness than its middle, as described.

211. INSTRUMENT FOR ADDING NUMBERS; John B. Newbrough, St. Louis, Missouri.

Claim—1st, The bent arm underlying the dial, so as to operate it without obstructing the vision. 2d, The stud, operating in the described connexion with the pawl to permit the backward motion of the dial, for the purpose set forth. 3d, The combination and arrangement of the rib, cavity, catch, and teeth, operating as explained, to shift the obstructing plate at each revolution of the dial, and arrest the reverse motion of the latter at the right instant in setting the machine. 4th, The described arrangement and combination of the pins and hook, operating in the manner set forth.

212. MACHINES FOR HARVESTING BEANS; S. Van Rensselaer Newman, Covington, New York.

Claim—1st, The employment or use of the rotary sickles, provided with scolloped-shaped teeth, and arranged to operate as set forth. 2d, The combination of the endless chain of rods with the rotary sickles. 3d, The combination of the rotary sickles, endless chain of rods, platform, with or without the rake, placed in a mounted frame, and arranged for joint operation.

213. FIRE-BACK FOR STOVES AND FIRE-PLACES; Andrew O'Neill, Portsmouth, Ohio.

Claim—The hooded damper, in combination with a radiating fire-back, arranged as described.

214. CULTIVATORS; James Peeler, Tallahasse, Florida.

Claim—The arrangement of the bars, D and E, beam, handles, and standard, the bar, E, forming a brace, a coulter, and a landside, and the bar, D, being provided with an inclined or tapering point, on which any style of blade may be secured, the two bars being pivoted together, and the whole operating in the manner specified.

215. MACHINES FOR CUTTING SUGAR CANE; Albert Philipp, Mayville, Wisconsin.

Claim—The arrangement of the cutters, H', with the forked arms, I', and with the endless apron, in combination with the cutters, H, the forked arms, I, the reels, and the additional platforms, to operate in the manner specified.

216. APPARATUS FOR MANUFACTURE OF PAPER PULP; Joseph B. Palser and Gardner Howland, Fort Edward, New York.

Claim—1st, Having the pipe, b, which passes through the hollow journal of the boiler, divided by a partition, so that the steam may find exit through one compartment of the pipe and the contents of the boiler through the other compartment. 2d, The employment of the perforated diaphragm, when arranged as described, to protect the pipes, b b' s s', and strain the liquids from the "stock." 3d, The arrangement of the boilers, J J', with the surrounding envelope, as described, so that the resultant liquids of the boiling may be evaporated, and also employed to cool down the boilers and surrounding envelope. 4th, The arrangement of the basin below the boiler to receive the falling liquid, as described. 5th, The injection of the steam arising from the boiling of the alkaline and other contents of boiler, J', into boiler, J, and vice-versa, as described. 6th, The arrangement of the warming chamber between the two boilers, and the combination therewith of the pipes, T V W W', as described. 7th, The arrangement and combination of the boilers, furnace, and doors, so as to apply the furnace heat to either or both boilers at pleasure, as described. 8th, The combination of the cylindrical bottomed vats, having the chimneys passing through them, with the boilers, as described.

217. MACHINES FOR SOWING FERTILIZERS; James Peeler, Talahassee, Florida.

Claim—The arrangement of the frame, wheels, axle, and apron, attached to the frame by means of straps, with the bar, metallic strip, corrugated wheel, bar, chuck, hopper, and slide, the whole being constructed and placed in the relative positions set forth.

218. BRAKES FOR POWER LOOMS; Rensselaer and Gordon B. Reynolds, Stockport, New York; ante-dated Feb. 8, 1859.

Claim—Applying and arranging the two faces of the brake relatively to its centre of motion, and the said centre of motion relatively to the centres of the crank and cam shafts, in the manner described, whereby the brake is not only rendered automatic in case of recoil after the stoppage of the loom by the action of the protector, but self-liberating when the loom is started again.

219. FILTER; Wm. Rice, Philadelphia, Pennsylvania.

Claim—1st, The general arrangement of the two casings, the perforated plates, the wire gauze, body of sand, the system of pipes, and three cocks, as described. 2d, Confining a body of sand between the perforated plates, by means of a ring, constructed in the manner set forth, or any equivalent thereto, by which the said ring may be made to compress the body of sand without disturbing the said perforated plates. 3d, The orifices at the lower ends of the pipes, for the purpose specified.

220. CIDER PRESSES; Christian Ritter, Reading, Pennsylvania.

Claim—The application of the chamfered and grooved inner slats and partitions, with their fastenings and arrangements, which will produce the intended effect.

221. BRUSH FOR WASHING WINDOWS; Philip C. Rowe, Boston, Massachusetts.

Claim—The hydraulic window-washer or brush, constructed with the spray-jet tube, and the conduit or pipe applied to its stock and handle, in manner as specified.

222. COOKING RANGES; Wm. G. Ruggles, Worcester, Massachusetts.

Claim—The arrangement and combination of the oven, D, provided with a central hollow shelf, h, the oven, G, provided with a hollow shelf, m, fire chamber, B, damper, E, chambers, h d, flues, c H n n', as described.

223. DOOR FRAMES FOR FURNACES; Paul A. Sabbaton, Albany, New York.

Claim—The combination of the mouth of the furnace of the door frame and door, when the said door

frame is provided with an opening larger than the door into which the door shuts, so as to close against the furnace or against a shield or false frame, as described.

224. Tool for Planing and Finishing the Edges of Boot and Shoe Soles; Henry Sauerbier, Newark, New Jersey.

Claim—The combination of the collis and edge plane, in the manner specified.

225. Harvesting Machines; Wm. and Thomas Schnebly, Hackensack, New Jersey.

Claim—The arrangement and combination of the inclined tapering discharge trough, with the concave or curved platform and raker-reel, whereby the grain is made to fall from the machine in compact gavels, as described.

226. Harvesting Machines; Wm. and Thomas Schnebly, Hackensack, New Jersey.

Claim—The employment, in combination with the pendulous levers, d d', of the toggle levers, g g, as shown, whereby the levers, d d', may, without shifting their axes of motion, be thrown in or out of connexion with the drivers.

227. Water-wheel; Jonas Smith, Westport, Connecticut.

Claim—The arrangement and combination of the annular gate, when provided with the tangential vertical plates, stationary rim, interposed between the gate, and wheel, when provided with buckets having lips, all as described.

[To that class of horizontal water-wheels called "centre discharge wheels," this invention will be found to be applicable. The invention consists in the employment of a circular gate, formed of a series of guide passages, and placed over or around a stationary rim having induction openings made in it, the wheel having peculiar buckets—the whole is so arranged that the admission of water to the wheel may be regulated as desired with great nicety, and in such a way that the greatest effect will be produced from a given volume of water, whether it be large or small.]

228. Measuring Faucets; Joseph Smith, Cincinnati, Ohio, and G. B. Griffin, Madison, Wisconsin.

Claim—1st, Operating the plunger by means of the cam grooves on the face of wheel, in connexion with the pins on the sleeve, when both are constructed and operated in the manner set forth. 2d, The serrated circular register plate, in connexion with the ratchet and pointer, in the manner specified. 3d, The disc, constructed as described, in combination with the inlet pipe and the outlet pipe.

229. Machine for Jointing Staves; John G. Stephenson, Buffalo, New York.

Claim—The adjustable plates with yielding cutter stocks or plates attached in connexion with the feed rollers and yielding pressure plate, or its equivalent, arranged to operate as set forth.

230. Cultivators; J. C. Stoddard, Worcester, Massachusetts.

Claim—The arrangement and combination of the slotted, adjustable, reversible blades, arms, and hub, as described.

231. Panoramic Attachment for Clocks to Indicate the Comparative Time in all Longitudes; Giles M. Stone, Fredericksburgh, Virginia.

Claim—1st, The chronometer dial divided off into 24 equal parts for indicating the 24 hours of day and night, by one revolution of the index point. 2d, The revolving disc representing the northern or southern hemisphere, for indicating the relative time of day or night, at any and all localities thereon. 3d, The combination of the revolving disc with the 24 hour dial, for demonstrating the cause of day and night by the diurnal revolutions of the former, representing the revolutions of the earth on its own axis.

232. Combined Case for Pen, Pencil, Knife, Toothpick, &c.; John F. Sturdy, Attleborough, Massachusetts.

Claim—The case, constructed as shown, and provided with the blade knife, operated by the spirally slotted tube, pencil tube, toothpick, and pen-slide.

233. Clothes Pin; William H. Towers, City of New York.

Claim—A clothes clamp, formed of two parts jointed together at their upper ends, as set forth.

234. Apparatus to Hold and Turn the Leaves of Books and Music; Cyrus B. Thayer, Boston, Mass.

Claim—The combination and arrangement of the wedge-acting back pieces and clamps with their connecting dovetail tongues and grooves, so that simply raising the clamps shall unclamp and depress them, shall clamp the music sheets. Also, the arrangement and combination of the leaf-turning cords, arms, lever, and catch.

235. Machines for Digging Potatoes; George F. Tiffany, Palmyra, Michigan.

Claim—The hinged fork, in combination with the plough, arranged as set forth.

[In front of the cart body an adjustable plough is placed, constructed with closed sides, and operating by means of a wheel placed in front of it, so as to be self-adjusting while passing over the potato hills, adapting itself to the various depths of hills, and ploughing up the potatoes and sending them on to an endless riddle, where the dirt is cleaned off them.

236. Manufacture of Gas; Charles N. Tyler, Washington City, D. C.

Claim—Combining hydrogen gas with the volatile and easily condensible products of coal, resin, tar, &c., in their nascent state, in the manner set forth.

237. Cultivators; Franklin Veal, Hallettsville, Texas.

Claim—Arranging the dovetailed projection at equal distances from the cutting edges of the shares, in combination with the slots and receces in the arms, and for the purpose of securing the shares to the arms, and to render them reversible.

[This cultivator is especially adapted for hilling and weeding young crops of cotton, corn, or root crops, as it runs between two rows, throwing up the ground on each side, or it straddles two rows by a proper adjustment of the shares.]

238. Screw Propeller; Jules Jean Baptiste Vergne, Paris, France.

Claim—The arrangement of the grooving fluting or ribs in the form of a series of steps, as described.

239. Fluid Lamps; Anton Von Schuttenback, St. Petersburgh, Russia; patented in England, Oct. 11, 1858.

Claim—The combination of the gas-holder or gasometer, the vessel, the pipe, N, with its branches, the pipe, F, the chamber, the chimney, the oil reservoir, and the burner, the whole being applied as specified.

240. Gas Retorts; Edward Walcott, Providence, Rhode Island.

Claim—1st, The combination with the lid of the projecting incline plane, as described. 2d, The employ-

ment for securing the lid of the mouth-piece of the retort in place of a horizontal eccentric or cam and lever, attached to, and combined with, a cross-bar, and applied to the mouth-piece of the retort, as described.

241. Railroad Car Seats; F. F. Wagner and P. P. Dickinson, Harrisburgh, Pennsylvania.

Claim—The arrangement and combination of the wheels, arms, cushions, and bars, as described.

[This invention consists in arranging on each side of the seat two cushions which fold one on the top of the other, and which are attached to arms that are connected by a series of gear wheels in such a manner that the cushions attached to one side of the seat are always situated on a plane parallel to the plane which passes through the cushions on the other side, so that when the cushions on one side are used for the back of the seat, those on the other form leg rests, and vice-versa, and by bringing the cushions in a horizontal position the seats are changed into sleeping couches.]

242. Body Bolsters for Railway Cars; Ambrose Ward, Altoona, Pennsylvania.

Claim—1st, The arrangement and combination of the trusses, centre plate, D, sills, and tension rods, as described. 2d, Providing the centre plate, D, with lugs, protecting flanch, or cap, lateral bearing flanch at the centre fitting into cup in plate, B, the vertical bearing flanch fitting into the cup or groove in plate, B, arranged as described.

[The centre plates are so arranged that the lateral friction between the upper and lower centre plate is reduced to a very small diameter, and sufficient room is obtained for circulating the oil or lubricating matter, and at the same time the dirt is excluded by means of a flanch attached to the upper plate and fitting over the lower one, and struts are cast to the upper centre plate in such a manner that they form steps for the truss timbers, and the downward pressure on either side of the car is sustained by the outer rings of the centre plates.]

243. Method of Opening and Closing Farm Gates; David Warren, Gettysburgh, Pennsylvania.

Claim—The arrangement of the lever and bar, d, with the bar, E, and falling catch, constructed in the manner described.

244. Cultivators; Henry Wells, Walnut Grove, Illinois.

Claim—The arrangement of the share, mould-boards, rods, H H and I I, the latter having the parts, d d, formed on them, the said parts passing respectively through the bar and beam, thus making a very firm structure, in the manner set forth.

245. Trace Fastener; Solon R. Atkins and D. H. Hull, Assignors to D. H. Hull, Plantsville, Connecticut.

Claim—The metallic box, having a semicircular ring on its end, and provided with a slide which is to be operated by a knob, and held against the neck of the button on the whiffle-tree by springs, arranged in the manner set forth.

246. Device for Feeding Bees; Wm. Brown, Assignor to self and Fontain G. Robertson, Shelbyville, Ind.

Claim—The bottle-stopper, consisting of the cork, tube, and cup, secured together by the screw and nut, as described.

247. Heels for Boots and Shoes; Walter Hunt, City of New York.

Claim—Making the external form of the heels of boots and shoes of a metallic shell with an inner flanch at the upper edge, to fit over the usual heel seat of the sole and between that and the counter or back portion of the upper, and to be provided with an inner core, and the whole to be secured to the heel seat. Also, in combination with the shell, and upper flanch, and inner core, making the said shell with an inner flanch at the lower edge. Also, in combination with a heel, constructed as above described, and consisting of the shell with the upper and lower flanches and the enclosed core, the employment of a rotating top lift, as specified.

248. Water Gauges for Steam Boilers; Robert H. Mathies, Boston, Assignor to A. N. Clark, Beverly, Mass.

Claim—The combination, with the partition that separates the upper and lower main tubes of the gauge of the independent steam and water tubes or courses, arranged to unite the spaces in the main tube, as specified.

249. Double Cannon for Chain Shot; Wm. M. Jeffers, Assignor to self and Wm. L. Gibson, Elmira, N. Y.

Claim—The use of a partition intermediate between the breech and muzzle of the piece, in combination with the slot, so arranged that the charge of the barrels shall mingle at the fuse, so that immediately on the ignition thereof the expansive force shall be wholly expended in projecting the two balls, and not weakened by a continuous connexion between the barrels.

250. Water Gauges for Steam Boilers; H. K. Moore, Malden, Assignor to A. W. Adams and G. W. Dane, Boston, and Wm. G. Howe, Haverhill, Massachusetts.

I do not claim the single balanced valve apparatus, constructed with the arrangement of steam-receiving and discharging chambers, hollow stem or passage, external steam passage, and parts, d d. But I

Claim—Combining therewith the auxiliary steam space, and the nipple or raised valve seats, arranged as specified.

251. Cheese Cover; E. L. Pratt, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—As an improved article of manufacture, for the purposes described, a ventilating cover constructed of tin plate, or other suitable material, so as to protect articles placed therein from the rays of light and heat, and the ravages of animals or insects, and at the same time secure perfect ventilation, by means of a series of small perforations at or near the base or bottom for the inlet of cool air, and another series of perforations at or near the top for the escape of warm air moisture and gases.

252. Railroad Turn-tables; Archibald and James H. Putnam, Assignors to selves and Philip S. Geisse, Wellsville, Ohio.

Claim—The adjustable spindle, applied and adapted in the manner set forth.

253. Lock Guard; Lawrence Schroder, Assignor to John H. Schroder & Co., Cincinnati, Ohio.

Claim—The arrangement of the several tumblers, in combination with intervening springs, which vary the spaces between said tumblers and operate the lock, in the manner set forth.

254. Gas Retorts; John W. Smith, Washington City, D. C., Assignor to self and Jesse H. Whitehurst, Baltimore, Maryland.

Claim—The described arrangement of the pipes, e and e', when combined with the retort and condensing chamber, in the manner set forth.

255. Smelting Furnace for Iron; Robert Wm. Sievier, Upper Holloway, Middlesex Co., England, Assignor to Wm. Lilley, Ohio.

Claim—The use of the exhaust pipe in connexion with a fan pump, or other means, to exhaust the foul

air and gases, and cause a current of air to pass through the bottom or apertures of the furnace of sufficient density for the smelting and purifying iron and other ores, in the manner set forth. Also, the exhaust fan, constructed and operating as explained. Further, the use of the movable crucible, as described.

256. Edge Plane for Boots and Shoes; Benjamin Tolman, Assignor to self and Asa F. Ramsdell, Pembroke, Massachusetts.

Claim—The improved edge plane, as constructed, with cutter and gauge bearings, flanches, and confining devices arranged on the stock, and with respect to the cutter and gauge, as specified.

257. Patterns for Casting Stove Covers; Charles Teuesdale and A. J. Sennett, Assignors to Wm. and Jacob Resor, Cincinnati, Ohio.

Claim—Constructing patterns for stove covers and centres, with an opening in their under sides, by means of which a draw bar may be withdrawn from the mould before removing the pattern, and also with a perforation, as set forth.

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258. Constructing Rims and Field-pieces for Watch and Locket Cases; J. N. Allen, Providence, R. I.

Claim—Making the rim and field-piece for watch or locket cases from a strip of sheet metal, as described.

259. Vapor Lamp Burners; C. M. Alexander, New Albany, Indiana.

Claim—The combination of a retort having converging sides, and constructed in the manner set forth, with an inlet pipe and an outlet pipe, and a burner, for the purpose of forming a gas generating apparatus, to be used in connexion with fluid lamps.

260. Seeding Machines; J. C. Bean, Grayville, Illinois.

Claim—The arrangement of the hopper and arms, in combination with the inclined equalizer, as set forth.

261. Gas Retorts; William Beaumont, Paterson, New Jersey.

Claim—Making all that part of a retort which is most subject to expansion and contraction, corrugated to prevent fracture.

262. Contrivance by which the Workman Operates Scroll Saws; Edward Beck, Allentown, Pennsylvania.

Claim—The oscillating platform connected with the shaft by means of the straps and pulley, or their equivalents, the arm, pitman, and spring, arranged for joint operation as set forth.

263. Railroad Bars or Rails; Henry Betts, Hamilton, C. W.

Claim—The angle rail, in combination with the outside bar, where the space between them is filled in with cement, prepared by boiling sand and coal tar, in such proportions as will best resist the action of the elements, cold, heat, and moisture, and the wear of the wheels.

264. Fire-proof Desk; M. B. Bigelow and Anson Hardy, Boston, Massachusetts.

Claim—The movable table, or any device essentially the same, in combination with the fire-proof case, said table being constructed and made so as to operate in the manner specified. Also, the slide, or any device essentially the same, in combination with the movable table and the fire-proof case, for supporting or assisting to support said movable table, whenever said table is drawn out to the position shown in fig. 2, said slide and table being connected and made so as to operate in the manner specified. Also, the brackets, or any device substantially the same, in combination with the fire-proof case for supporting, or assisting to support, the movable table and the slide, in the manner explained.

265. Spring Hinge; Nelson Birdsall, Port Jervis, New York.

Claim—The combination and arrangement of the spring and adjusting piece applied to a hinge, as described. Also, inserting within the spiral spring the tubular spring, as described, for assisting the action of the spiral spring, and preventing it from setting or getting out of place with the other parts.

266. Ploughs; L. E. Burdin, Paris, Kentucky.

Claim—The arrangement of the beam, the handles, the standard, brace, H, share, landside, cone, spindle, or shaft, braces, C and G, and lug, as described.

267. Corn Planters; Alexander, William, and James Campbell, Harrison, Ohio.

Claim—The described arrangement of the inclined slides or valves, levers, adjustable rods, and cam wheel.

268. Job and Card Printing Press; J. A. Campbell, New Orleans, Louisiana.

Claim—Fastening the cylinder permanently on its solid axle, and also fastening the ends of this axle securely into the slides. Also, in combination with the cylinder, the revolving of the roller frame on the solid axle as its working centre, while the axle itself does not revolve either by eccentric wheels, which are to be used when the cylinder vibrates, or by plain ones when it is stationary. Also, the eccentric wheels, in combination with the cylinder. Also, the cranks, R, and connecting rods, D, in combination with the cylinder, the inking frame, and the eccentric wheels. Also, the combination of the cranks, S, the connecting rods, T, the slots, the pins, and the bottoms, with this press, as specified.

269. Stoves; W. J. Cantelo, Burlington, New Jersey.

Claim—The exterior casing and inner adjustable casing, in combination with the fire-pot and cone-shaped grate, when the several parts are arranged as set forth.

270. Machines for Hoisting Bricks; T. F. Christman, Wilson, North Carolina.

Claim—The combination of the rollers, D D, with the saddle and buckets, E F, supported by rollers, J J, as set forth.

271. Seed Planters; Giles Cramton, Marshall, Michigan.

Claim—The application and use of the pulleys, in combination with the adjustable hanger, tension bar, lever, and yoke, with its attached spring stops, arranged as specified.

272. Machines for Sowing Fertilizers in Drills; C. B. Davis, Lawrenceburgh, Tennessee.

Claim—The arrangement of the hopper, wheels, frame, handles, D D, shoe, E, handle of shoe, H, pins on wheel, and axle-trees, as described.

273. APPARATUS FOR PURIFYING GAS; Aurelius Dickinson, Claremont, New Hampshire.

Claim—The washer, constructed with horizontal platea, corrugated or with the bottoms partly or wholly concave, and with upright plates projecting above and below the said plates, and dipping into the water below the said plates, and with orifices so arranged in the highest portions of the said horizontal plate, as to cause the collection of the gas in the concave portions of the said plates, below and around said orifices.

274. BASES FOR ARTIFICIAL TEETH; George Dieffenbach, City of New York.

Claim—The composition of matter consisting of sulphate of alumina, and other ingredients, substantially as described.

275. PROCESS FOR COLORING ARTIFICIAL TEETH; George Dieffenbach, City of New York.

Claim—Developing the color of a cured or hardened composition, by the agency of solar light, when the coloring matter is incorporated into the said composition, while in its plastic or uncured state.

276. CONNECTING BOARDS FOR ROOFS, &c.; Wm. T. DeGolyer, Schenectady, New York.

Claim—Covering the joints of board or plank for roofing, by means of sheets of metal bent in the form shown, so that the strips of wood, or other packing used, shall lie on as well as against the flanches turned on said metal.

277. FURNACES; J. H. Duhme, Cincinnati, Ohio.

Claim—The arrangement of the flue spaces controlled by dampers, for the purpose of increasing and perfecting the combustion, as set forth.

278. CARTRIDGES; J. H. Ferguson, Baltimore, Maryland.

Claim—A water-proof and inflammable cartridge, made as described.

279. HARVESTING MACHINES; B. G. Fitzhugh, Frederick, Maryland.

Claim—The combination of a rake and reel revolving on the same shaft, when the rake is so made as to deliver the cut material in a line oblique to the swath of the machine.

280. GRAIN CRADLES; M. R. Flanders, Parishville, New York.

Claim—Attaching the finger standard to the swath by means of the rod and eye, secured respectively to the standard and snath in connexion with the compensating or adjustable braces, arranged as set forth.

281. GAS PURIFIERS; Peter Fontain, Philadelphia, Pennsylvania.

Claim—The receptacle or receiver, in combination with the filtering and purifying apparatus, arranged as described.

282. RECIPROCATING PROPELLER; John Galt, Philadelphia, Pennsylvania.

Claim—Combining the buckets with the frames and with the driving rods, or their equivalents, by means of cross-heads, link connexions, and slots, substantially as specified. Also, the construction of the propellers with the frames of flaring form, and with their buckets fitted to the smaller front portions thereof. Also, constructing the driving rods, each in two parts, one of which connected with the buckets, is capable of being connected with, or disconnected from, the other at pleasure, for the purpose either of closing the buckets before the backward movement, and opening them before the forward movement of the propeller frame commences, or of causing the closing of the buckets before the forward, and the opening of them before the backward movement, as may be desired, and thereby enabling the action of the propeller to be reversed, without reversing the engine.

283. LET-OFF MOTION FOR LOOMS; Wm. H. Gray, Dover, New Hampshire.

Claim—The board or plate and springs, applied to the breast beam of the loom, and combined with a clutch by which the yarn-beam can be thrown into gear with the cam shaft or crank shaft of the loom, to operate substantially as described.

284. ROTARY HARROWS; Christian and J. K. Gingrich, Annville, Pennsylvania.

Claim—The clearers, in combination with roller and ring, when arranged as set forth.

[Clearers are arranged upon the weighted arm of a rotating harrow, so as to precede the traveler or friction roller which supports the weight, and keep the annular ring upon which the traveler rolls clear of dirt in using the harrow, and an adjustable draft bar is added to place the line of draft in any position that may be desirable.]

285. RAKING ATTACHMENT FOR HARVESTERS; C. P. Gronberg, Montgomery, Illinois.

Claim—The peculiar arrangement of the mechanism, namely, the reciprocating rack bar and semicircular toothed bar, in connexion with the bent rack shaft, provided with a spring, arm, and part pinion, and the semicircular bar on the support provided with teeth and a projecting arm for joint operation, as set forth.

286. ALCOHOMETERS; Heinrich Guth, City of New York.

Claim—An alcohol indicator, substantially as described, by which the evaporation of a fixed quantity of alcoholic liquid is made to indicate the exact per centage of alcohol contained in the said liquid.

287. MACHINE FOR MAKING UPHOLSTERY SPRINGS; James Harrison, Jr., City of New York.

Claim—1st, Giving one or more of the forming rollers a positive rotary motion at a velocity which causes its or their periphery or peripheries to move faster than the periphery of that part of the mandrel in conjunction with it or them at any time in the operation. 2d, Connecting the axle of the roller, or any of the forming rollers, by a link and two universal joints, with a shaft having a longitudinally sliding and also a rotary motion, for the purpose of giving the said roller a rotary motion and a motion along the mandrel, and allowing it to accommodate its position to the varying diameter of the mandrel.

288. SHIP'S CAPSTANS; J. F. Holloway, Saline Mines, Illinois.

Claim—A capstan having a vertical movement as well as a rotary one, substantially in the manner specified.

289. STOVES; Marcus L. Horton, Lebanon, New Hampshire.

Claim—The ventilator with valve and hood, as arranged, and in combination with chambers and flues, operating as described.

290. APPARATUS FOR TANNING; D. L. Hubbard, Glastenbury, Connecticut.

Claim—The wheel or cylinder having its periphery formed of oblique slats placed within the vat, and arranged to operate as set forth. Further, in combination with the wheel or cylinder, constructed as described, the apron, for the purpose specified.

291. Apparatus for Condensing Coal Oils; W. G. W. Jaeger, Baltimore, Maryland.

Claim—The employment of a fan-blower, when the same is used to draw the vapors from the retort, in the manner set forth. Also, in combination with the fan-blower or draft so used, I claim the escape pipe and trap, arranged as set forth.

292. Bedstead Fastening; J. C. Jeffries, Mount Vernon, Indiana.

Claim—The construction of a bedstead fastening formed with male and female plates, provided with tongues and hooks, when arranged in combination with a post and rail, in the manner as set forth.

293. Arranging Couches in Railroad Cars; E. C. Knight, Philadelphia, Pennsylvania.

Claim—1st, The mode of arranging berths or couches over backs of railroad car seats, as set forth. 2d, The manner of supporting the backs of the seats by slides and rods, for the purpose described.

294. Cross-cut Sawing Machine; M. W. Knox, Sheridan, New York.

Claim—1st, The arrangement of the several parts of a sawing machine, as herein described, whereby the operator can manage the sawing, elevating, and depressing the saw, and opening and closing the clamp, without changing his position in relation to the machine. 2d, The guides and blocks, when arranged in combination with the saw, in the manner specified.

295. Braiding Machines; Isaac W. Lamb, West Novi, Michigan.

Claim—1st, The combination of the two sets of shuttle-carriers, rotating in opposite directions in concentric circles, and the shuttle-changers, having the movements described. 2d, The construction of the shuttles, each with two openings, and with a spring dog entering both openings, to operate in combination with the inclined surfaces and stops of the shuttle-carriers and shuttle-changers. 3d, The combination with the shuttles of the nippers, and their several appendages and appliances, by which their bite or friction upon the plaits are regulated and rendered uniform, substantially as described.

296. Preserve Cans; W. D. Ludlow, City of New York.

Claim—The described combination of the key with lugs attached, in the manner shown, to the sides of a cavity in the top of the can, in order to prevent the disruption of the said lugs during the act of closing the can, and avoid projections above or beyond its periphery.

297. Machine for Folding and Packing Wool; Wm. H. Main, Liverpool, Ohio.

Claim—The devices for rolling the fleece into a compact cylindrical form, namely, the combination of the belt, rod, hooks, and pins, the same being operated by means of the windlass and screw, in the manner specified.

298. Cultivator Teeth; Gardner Maynard, Ilion, New York.

Claim—The arrangement of the tooth, stay, and wrought iron stem and brace, when the stem is welded between the wings of the tooth and made to form a brace, as set forth.

299. Packing for Stuffing-boxes of Pistons; Charles M. Barney, Roxbury, Massachusetts.

Claim—A packing for stuffing-boxes composed of canvass and india rubber, as set forth, and cut diagonally, as described.

300. Machines for Pulverizing Minerals; Samuel and George E. Mills, City of New York.

Claim—A series of circular grooved and roughened metallic plates working upon their edges side by side in a trough or cylinder, the circle being larger than the plates, which have an alternating motion in combination with each other and the cylinder, and in connexion with the rock shafts and levers for operating the same.

301. Machine for Finishing Hair-brush Handles; Thomas Mitchell, Lansingburg, New York.

Claim—The rotating cutter wheels, and guards, and guides, in combination with the clamps provided with patterns, arranged as set forth. Also, centering the unfinished brushes in the clamp by means of the bristles, in connexion with the strip or plate and the inner edge of the pattern or its extension, as described.

302. Defecating Sugar Juices; Marie Heloise Nicolas and Louise Josephine Champagne, Thibodeaux, La.

Claim—The employment in the bleaching and defecating of sugar juices, of the herein described combination of sulphur and lime, prepared in the manner set forth.

303. Animal Trap; Henry S. North and John O. Couch, Middletown, Connecticut.

Claim—1st, The combination of the many-chambered cylinder with the breech-pin, by means of a central counter-bore in the said cylinder, meeting the chambers, and a groove or recess all round the end of the breech-pin, whereby communication is made between the chambers of the cylinder, and all are enabled to be fired at once with a single vent. 2d, Fitting the hammer in the form of a ring to slide along the exterior of the breech-pin. 3d, The combination with the hammer applied to slide along the exterior of the hollow breech-pin, of a rod sliding through the centre of the cylinder and within the breech-pin, and a spring sear attached to the said rod, and working through a slot in the breech-pin, as described. 4th, The combination with the hammer applied outside of the hollow breech-pin of a collar, or its equivalent, applied within the breech-pin, and having pins or ears projecting through slots in the sides of the breech-pin behind the hammer, and a helical spring applied within the breech-pin, behind the said collar, or equivalent. 5th, The extension of the central rod which carries the sear directly through the cylinder and through the hollow breech-pin, so that it may be operated either by a pull at its front end or by a push at its rear end. 6th, In combination with the many-chambered cylinder, hollow breech-pin, hammer, central rod, sear, and spring, and collar, as described, we claim the stock and trigger, applied as described, to make a weapon that can be baited and set for shooting game, by the seizure of the bait, or that can be used in the hand like an ordinary pistol or fire arm.

304. Tool-holders for Lathes; Charles Peck, New Haven, Connecticut.

Claim—1st, The combination of the tool-rest with the segment, or their mechanical equivalents, so as to elevate or depress the cutting instrument, when arranged in the manner described. 2d, The T-slotted bedplate with the tool-rest connecting the tool-posts, when combined in the manner described, so as to allow the cutting tool to be placed at any required angle horizontally.

305. Clothes Dryer; George Race, Norwich, New York.

Claim—1st, The employment of a hollow post enclosing the arms of the reel, in which the arms may be elevated and depressed through its top, in the manner set forth. 2d, The combination of the sliding head and the arms hinged to said head at their lower extremities, and connected by cords, or other equivalent connexion, at their upper extremities, as described. 3d, The combination with the foregoing of the cord and

pulleys, the pinion, rack, and latch, for elevating and securing the head in the hollow post, when constructed in the manner set forth.

306. Machine for Driving Hoops on Pails, &c.; Wm. Raymond, Marlboro', New Hampshire.

Claim—The employment of a driver, when either fixed or turning loosely in its bearings, and operated by means of a jointed lever, or otherwise, so as to press against and drive the hoop upon the tub, when a rotary motion is given to said tub.

307. Cooking Ranges; Wm. Resor, Cincinnati, Ohio.

Claim—The peculiar construction of the plate which constitutes the upper plate of the stove, forming, as it does, the plate of the stove, the arched roof of the damper chamber, and part of the chimney pipe, in the manner set forth.

308. Mode of Lifting Stamps for Crushing Ores; Delos E. Rice, Detroit, Michigan.

Claim—The application of the folding wedges, in combination with the band, or their equivalents, thereby producing a uniform lift of the rods together with the stamp heads.

309. Machine for Turning Hubs; Alex. Rickert, Schoharie, New York.

Claim—1st, The graduated scale, in combination with the index, and the sliding frame, and hub blank, and mandrel, operating in connexion with the cutters, in the manner described. 2d, The constructing the sliding sleeve with an opening at the angle so as to slide over and upon the large cutter on the shaft, so as to cut any required size of hub without change of knife, as described. Also, the constructing the sliding sleeve (or cutter and stock,) to pass over and mask the fixed knife on the shaft, in connexion and combination with the making one of the sides of the sleeve thicker and heavier than the other, in order to approximate to an equipoise of the shaft. 3d, The setting and adjusting (by means of the slot and screw-bolt) the arm, so as to cut any required length of hub, and so arranged upon the bar as to allow it to vibrate, for the purpose of bringing up the cutters to the hub or throwing them back when required, and without interfering with the screw or the adjustment of the arm.

310. Cotton Cultivators; Wm. J. Rivers, Sumter District, South Carolina.

Claim—The handles, helve, beam, foot bar, plough, harrow, roller frame, and roller, when arranged for joint operation as described.

311. Apparatus for Heating, Cooking, and Ventilating; C. B. Sawyer, Fitchburgh, Massachusetts.

Claim—The combination of the oven and range with the fire-pot, fire-flues, and air-pipes, as described.

312. Broom Clasp; P. B. Sheldon, Prattsburgh, Assignor to self and J. T. Upson, Huron, New York.

Claim—The feathers or ribs, in combination with the screw-threads of the shanks and with the handle, as described. Also, the combination of the conical screw shanks, conical screw ferrule, and screw-bolts, and nuts, arranged as set forth. Also, the wires attached to the jaws and arranged in combination therewith, in the manner described.

313. Corn Shellers; Adon Siddall, Ramson, Michigan.

Claim—The arrangement of the stirrup with the levers for operating the adjustable sliding pressure bar, in the manner described.

314. Power-pulley Presses; William and Robert Skene, Louisville, Kentucky.

Claim—1st, The arrangement of the scroll and the conical windlasses, E E′, to operate in combination with the windlass, H, and with the two followers, or their equivalents, as specified. 2d, Arranging the scroll and the windlasses, E E′, or their equivalents, on slides, which are rigidly attached to the upper follower, so that the weight of those parts assists in increasing the pressure on the substance placed between the two followers. 3d, The arrangement of the two followers with pulleys to operate, in combination with the scroll, the cone windlasses, and the ropes, substantially as set forth.

315. Power Gear Presses; William and Robert Skene, Louisville, Kentucky.

Claim—The arrangement of the windlasses, the weight, the scroll, and the pinion, n, to operate in combination with the cog-wheel, the pinions, E and E′, the double rack, and the follower, substantially as specified.

316. Carpet Fastener; M. D. and S. A. Snyder, Clarendon, New York.

Claim—An improved carpet hook, consisting of the barbed shank, gauge notch, throat, and rectangular clinching hook, constructed in the manner described.

317. Retorts for Distillation of Coal; John L. Stewart, East Boston, Massachusetts.

Claim—My improved revolving web retort, constructed not only with its induction and eduction openings arranged at or near one end of it, but with an endless, or other proper carrier, made so as to operate to receive the coal or matter to be distilled from or near one end of the retort, and carry or force the same toward the opposite end thereof, and from thence backward toward the front end, and there discharge such, the same causing the coal or matter to be distilled to pass twice through the retort or carbonizing chamber, in manner and for securing advantages specified. And, furthermore, in combination with the retort or its discharging mouth, a water-sealing trough and an endless carrier to operate in such trough, substantially as specified, to receive or carry away from the retort the discharged coke or products, the water of the trough, under such application of it to the discharging mouth, serving to furnish vapor or steam to the retort in manner, and to effect an advantage in the distillation of the coal or matter therein, as specified.

318. Machines for Making Hay; J. C. Stoddard, Worcester, Massachusetts.

Claim—Arranging the rakes in radial slots between the two drum-heads, and fixing them therein, so as to serve the purpose of a hay-making, and by a single change, a hay-raking machine, in the manner set forth.

319. Apparatus for Drying Grain; Joseph Souter, Chicago, Illinois.

Claim—The drying of grain by means of heated air within a vertical cylindrical chamber, which is provided with a series of tapering rims and a central shaft, which is armed with a series of winged scattering wheels, when a fan, or some other equivalent means, is employed for producing an upward current of heated air through the said chamber, in the manner set forth.

320. Apparatus for Heating Buildings; George S. G. Spence, Boston, Massachusetts.

Claim—The arrangement of the elevated sides of the boiler, in combination with the pipe, or its equivalent, depressed within the same for heating and distributing the air, in the manner set forth.

321. HARVESTING MACHINES; A. G. Stipher, Richmond, Indiana.

Claim—1st, The employment or use of the tilting spring rake, in combination with the sliding raker frame, arranged as set forth. 2d, Operating the raker frame and raker, by means of the reciprocating bar, through the medium of the rack, cog-wheel, pulley, and cord, arranged as set forth. 3d The combination with the raker, the sliding trap-doors, operated by means of the bent levers, springs, and cams, as set forth.

322. DEFECATING SUGAR JUICES; A. A. Tait, Assignor to George B. Hartson, City of New York.

Claim—The employment of the sulphate of tin, applied in manner substantially as described, for defecating cane juice and syrups.

323. FRAMES FOR MANUFACTURE OF SOAP; R. P. Thomas, Syracuse, New York.

Claim—Lining soap frames in ordinary use with flexible metallic plates, in the manner set forth.

324. CORN PLANTERS; C. G. Udell, Morris, Illinois.

Claim—1st, The arrangement of the grain box, tubes, connecting bars, and legs, constructed in the manner set forth. 2d, In combination with the above, I claim the measure, marking rod, and guide, constructed in the manner set forth.

325. MACHINE FOR HULLING AND SCOURING GRAIN; T. F. Wagoner, Trenton, New Jersey.

Claim—The combination of two surfaces, one of which is elastic and the other hard, when the planes of said surfaces are placed on a plane with the horizon, and one of them having a circular motion for the purpose of hulling and scouring grain, as set forth.

326. HORSE-SHOE MACHINE; H. L. Watts, Chester, Massachusetts.

Claim—The arrangement and combination of the slotted carriage, the die, the followers, the rollers, as described.

327. ROTARY CULTIVATORS; John Young, Joliet, Illinois.

Claim—The arrangement and combination of the skeleton or open rotary ploughing cylinder, when the mould-boards thereof are set tangential, and extend from end to end of the cylinder in a straight or oblique direction, in combination with a rotary shaft or circular edge discs, the whole being operated as set forth.

328. HARVESTING MACHINES; McClintock Young, Jr., Frederick, Maryland.

Claim—Combining the handle of the rake with the shaft by means of the supporter, the shaft arm, the crank, the pitman, h, and the pitman, i, and in such a manner that the rotation of said shaft will steadily and positively impart the desired movements to the rake. Also, the combination of the cams and the guides, or either of them, with the above described mechanism for operating the rake, constructed in the manner described.

329. FURNACES; E. B. Cherevy, Assignor to self and T. W. Weathered, City of New York.

Claim—The hollow dome, k, over the fire, in combination with the dome, h, in the manner and for the purposes specified, whereby the heat ascends into said dome, k, and then passes away between the domes, h and k, heating the circulating water, as specified. Also, the thimbles passing through the flanches and forming openings for the circulating water, as specified.

330. MODE OF IMPARTING MOMENTUM MOTION TO A SIFTING APPARATUS; Samuel Clark, Assignor to W. O. Bourne, City of New York.

Claim—1st, The imparting a short, quick, or jarring motion to a sifting apparatus, or machinery of any kind, where such motion is desirable, by means of an oscillating, vibrating, or reciprocating weight, brought, at the end of its motion, into contact with the said apparatus or its attachments, in the manner described, or its equivalent. 2d, Suspending the object to which the motion is applied by means of a suspending or supporting link or rod, with concave bearing parts uppermost at both ends and convex bearing parts undermost, constructed as above set forth, or in an equivalent manner.

331. SEEDING MACHINES; Daniel Foreman, Assignor to self, G. W. Sweringen, and Jonathan Penoyer, Navarre, Ohio.

Claim—The arrangement and combination with the interior of the peculiarly formed hollow slide of the adjustable plate, as described.

332. LET-OFF MOTION FOR LOOMS; W. H. Gray, Dover, New Hampshire, Assignor to self and Luther Robinson, Melrose, Massachusetts.

Claim—1st, Combining the clutch, or its equivalent, by which motion is imparted to the let-off mechanism, with the yarn-beam, by means of a worm-gear on the yarn-beam, and an endless screw and spring, applied, substantially as described, to the shaft which controls the rotation of the beam, and operating as set forth. 2d. In combination with the worm-gear, endless screw, and spring, applied as described, I claim the lever applied between the said spring and the surface of the yarn on the beam, and operating as specified.

333. PORTABLE DOOR FASTENER; Levi C. Johnson, Assignor to self and J. B. Smith, Buffalo, New York.

Claim—The sliding bar (including the plate, F), when so constructed as to form the slot, and so connected and arranged with the plates, A and A', and bolt, B, as that when placed in the door for use, the bar will stand at right-angles with the bolt, and when folded for carrying in the pocket, the plate, F, will cover the teeth or spurs of plate, A, as described.

334. METHOD OF PROTECTING IRON FROM OXIDATION; E. G. Pomroy, City of New York, Assignor to J. R. Pomroy, Brooklyn, New York.

Claim—The preparation of iron by corroding or oxidizing its surface, for the express purpose of making the same rough and capable of being closely and firmly united with a covering of fire-proof paint, by means of rolling, or other mechanical force, and the application of the other processes above described to iron so prepared, in combination therewith.

335. GRAIN SEPARATORS; Austin Potter, Assignor to self and J. W. Norton, Williamson, New York.

Claim—The application of the adjustable slide-board to the endless riddle, in such a manner that the grain and straw can be made to impinge upon the end or more open meshes of the same, or upon the top, thereby varying and adapting the action to the quality of grain and straw, and employing the force with which it leaves the cylinder as a means of separating the two. Also, the combination and arrangement of the parts, consisting of the fan, self-vibrating riddle, with pulleys driven directly from the cylinder, elongated shaker and board, and intermediate adjustable slide-board, operating conjointly to form a more portable, cheap, and effective separating attachment to threshing machines.

336. Apparatus for Oiling Cylinders and the Pistons of Steam Engines; C. A. Stebbens, Assignor to self and R. J. Todd, Boston, Massachusetts.

Claim—The combination of the lifter and tubular holder, or their equivalent or equivalents, with the valve and the piston, the whole being constructed and applied together, and to a reservoir and its pump barrel, in the manner specified.

Extension.

1. Machines for Raising and Lowering Weights; Ephraim Morris, City of New York; patented July 5, 1845; extended June 28, 1859.

Claim—The manner of combining the barrel discs with the wheel, for the purpose of hoisting, lowering, or suspending weights by means of the ribs and grooves, or any analogous device. And the further combination therewith of the means employed to govern and regulate the action of said parts, namely, the friction bands and levers, the attaching or detaching lever, rolling shaft and bit, pin and slide-key, substantially as such manner and combination are shown, irrespective of the power employed to work the machinery, and also irrespective of the mode by which power is connected to the working parts.

Additional Improvement.

1. The Construction of Chairs, Sofas, &c.; Charles Robinson, Cambridgeport, Massachusetts; patented March 9. 1858; additional dated June 14, 1859.

Claim—Additional to the original improvement, the spring plate, arranged and operating in combination with the supporting blocks, as specified.

2. Railroad Car Springs; A. B. Davis, Philadelphia, Pennsylvania; patented February 15, 1859; additional dated June 28, 1859.

Claim—The bore and cover plate secured together by a bolt, or other suitable fastening, in combination with one or more loose plates placed within the box, so as to divide the latter into two or more compartments.

Re-Issues.

1. Cotton Gins; David G. Olmstead, Vicksburg, Mississippi, Assignee of R. A. L. McCurdy, Sabine Parish, Louisiana; patented June 26, 1855; re-issued July 15, 1856; re-re-issued June 14, 1859.

Claim—The revolving screen, cylinder, or shaft situated in the hopper or roll-box, so that the roll moves around it, when arranged in the manner described, whether as a single or double device, so as to perform any or all of the functions. Also, discharging the hulls and trash from the roll-box through the sides of the cotton gin.

2. Fastening Centre-bits; Able W. Streeler, Shellburne Falls, Massachusetts; patented Jan. 23, 1855; re-issued June 14, 1859.

Claim—Fastening a bit in its stock by means of a projection on one, and a suitable recess for it on the other, when combined with mechanical pressure or friction that will hold the projection and recess together.

3. Watea-backs for Ranges; James Ingram, City of New York; patented February 16, 1858; re-issued June 21, 1859.

Claim—Protecting the water-backs of ranges by the introduction of a movable fire-brick, soap-stone, or equivalent material, between the fire and said water-backs. Also, arranging said water-back, as set forth, whereby the same can be moved away from the fire to allow space for introducing said protecting fire-brick, or its equivalent. And in combination with aaid water-brick, the lever and weight, or their equivalent, to move the intervening soap-stone or fire-brick.

4. Bridges; D. C. McCallum, Owego, New York; patented Jan. 20, 1857; re-issued June 21, 1859.

Claim—So combining the arch cord or beam, the arch brace, and the abutment or pier of a bridge, as that the thrust of the arch shall be thrown down upon the abutment or pier, and any deflexion in the lower cord be counteracted by an upward force at the upper ends of the arch braces. Also, the method of lengthening or shortening the braces of a bridge truss or girder, by which the truss may be elevated or depressed, as required, by means of the yoke, the plate on the end of the brace, and the straining pieces with their nuts, as described.

5. Governors for Steam Engines; Charles T. Porter, City of New York; patented July 18, 1858; re-issued June 21, 1859.

Claim—1st, In combination with arms and very small balls, or their equivalents, revolving at a velocity several times greater than would be due or natural to them, considered as a conical pendulum, the employment of a counterpoise, applied as described, and so proportioned in weight as to balance, or nearly so, the centrifugal force developed by the revolution of the said arms and balls, or their equivalents. 2d, The employment, at the connexion between the arms and the central spindle of the governor, of a joint, constructed as described, whereby each arm is brought to the outside of the joint on one side, and made to thrust against the joint pin close to one end thereof at a right-angle, and at a distance from the axis of revolution.

6. Veneers: John A. Jackson, Assignee of Israel Amies, Philadelphia, Pennsylvania; patented December 11, 1855; re-issued June 21, 1859.

Claim—The embossed veneers described, the same being adapted for subsequent application in the construction and ornamenting of furniture, and other articles, to which veneers are or may be applicable.

7. Reaping Machines; Obed Hussey, Baltimore, Maryland; patented Aug. 7, 1847; re-issued April 14, 1857; re-re-issued June 21, 1859.

Claim—The combination of side and cross bearings of the guards, with flush edgea at or near the forks of the blades.

8. Reaping Machines; Obed Hussey, Baltimore, Maryland; patented Aug. 7, 1847; re-isaued April 14, 1857; re-re-issued June 21, 1859.

Claim—Scalloped cutters with their blades beveled, as described.

9. Process of Grinding Paper Pulp; Joseph Kingsland, Jr., Franklin, New Jersey; patented Dec. 23, 1856; re-issued June 28, 1859.

Claim—The process of reducing fibrous substances to pulp suitable for making paper, whilst such fibrous

substances are suspended in water, by subjecting them to the operation of grinding or beating action in a closed vessel, to which it is supplied by the hydraulic power of a descending column of water so charged with the fibrous substance, and permitting it to escape and be discharged so soon as it is sufficiently reduced. Also, separating the fibres from the mass so soon as they are sufficiently reduced, and discharging them by the hydrostatic pressure of the column of water in which the fibres are suspended, and which in flowing upward to the discharge carries with it only the fibres which are sufficiently reduced.

10. Machinery for Grinding Paper Pulp; Joseph Kingsland Jr., Franklin, New Jersey; patented Dec. 16, 1856; re-issued June 28, 1859.

Claim—The combination of the rotating grinder with, and inclosed in, a surrounding case, which constitutes the opposing grinding surface, and which is provided with a feeding pipe and discharge aperture, suitable for feeding or carrying the fibrous substances to and from the grinder in the inclosed vessel, by the hydraulic pressure of a descending column of water.

11. Brick Machines; Joseph W. Jayne, Sandusky, Ohio; patented May 5, 1857; re-issued June 28, 1859.

Claim—1st, The yoke, constructed in the form described, by which converging planes are held firmly in the same position relative to each other, whether the same be composed of one or more pieces of metal. 2d, The radial sliding and revolving chargers, in combination with the mould-wheel. 3d, The arrangement of the guide stem on one side of the pressers instead of on the end, whereby I am enabled to place the pressing roller in the cavity of the piston. 4th, Making the piston or presser hollow, and inserting the pressing roller in the cavity thereof (instead of placing it upon a guide stem as heretofore done).

12. Process of Manufacturing Wire Grating, &c.; Henry Jenkins, Brooklyn, New York; patented March 6, 1847; re-issued June 28, 1859.

Claim—Manufacturing screws, or other articles, from metallic wires or bars that are bent or crinkled at the point of intersection previously to being laid or woven up, whereby I am enabled to form meshes of any desired size or shape by such intersecting bars or wires, so that they shall be rigid and durable, as set forth, and this I claim irrespective of the mechanism for beading or crinkling said wires, or interweaving them to form the requisite meshes.

13. Washing Machines; Miner Van Auken, Saratoga Springs, New York; patented May 11, 1858; re-issued June 28, 1859.

Claim—1st, Providing a stop-board at the lower portion of the rear end of the rubber, as set forth. 2d, Providing an oblong slot, the lower termination of which is of scroll form, in each of the pendulous arms of the rubber, as set forth. 3d, The combination with said slot of a back trip-board, as set forth.

14. Machine for Finishing Brush Handles; John Ames, Assignee of Thomas Mitchell, Lansingburgh, New York; patented June 23, 1857; re-issued June 28, 1859.

Claim—1st, The combination of the crown-wheel saw with the adjustable platform and stop, as set forth. 2d, The wheel, provided with the oblique cutters, in combination with the guard or gauge piece, the cutter wheel and gauge piece being arranged relatively with each other, substantially as set forth. 3d, The arrangement and combination of the platform with revolving cutters shaped and operating as described, crown-saw, with the arms and the adjustable platform and cutter wheels, with their cutters, as described.

15. Valves for Dry Gas Metres; W Hopper and R. H. Gratz, Assignees of C. C. Lloyd, Philadelphia, Pa.; patented June 22, 1858; re-issued June 28, 1859.

Claim—1st, The combination of the rotary valve with a series of brakes or edges, arranged so as to escape the upper surface of the valve seat. 2d, The drip and valve seat, arranged so as to collect and carry off any liquid deposit in the metre. 3d, The valve carriage, arranged substantially as described. 4th, The combination of the valve, the valve seat, the shafts attached to the diaphragms, arranged for the purpose of restraining a reverse movement in the metre, and thus dispensing with the click and ratchet.

16. Ice Cream Freezers; H. B. Masser, Sunbury, Pennsylvania; patented Dec. 12, 1848; re-issued January 1, 1850; re-re-issued June 28, 1859.

Claim—A scraper or scrapers which act or bind during the process of freezing cream with a yielding spring force against the inner surface or surfaces of the cream chamber, as set forth.

Designs.

1. Sewing Machines; Solomon B. Ellithorp, City of New York; dated June 7, 1859.

2. Cook Stove; Anthony J. Gallagher and Jacob Beesley, Assignors to Anthony J. Gallagher, Philadelphia, Pennsylvania; dated June 7, 1859.

3. Stove Plates; S. W. Gibbs, Albany, New York, Assignor to Abbott & Lawrence, Philadelphia, Pennsylvania; dated June 14, 1859.

4. Stove Plates; S. W. Gibbs, Albany, New York, Assignor to Abbott & Lawrence, Philadelphia, Pennsylvania; dated June 14, 1859.

5. Top and Bases of Sheet Iron Stoves; S. W. Gibbs, Assignor to Rathbone & Co., Albany, New York; dated June 14, 1859.

6. Arms of Sewing Machines; James S. McCurdy, Brooklyn, New York, Assignor to John M. Myers, City of New York; dated June 14, 1859.

7. Match-boxes; P. J. Clark, Assignor to S. S. Clark, West Meriden, Connecticut; dated June 28, 1859.

JULY 5.

1. Furniture Caster; Demas S. Barnes, City of New York.

Claim—The spherical roller with its axle running in the frame work, in combination with the two convex surfaces, or with the convex and concave surfaces, so as to enable the same readily to revolve on a vertical axis, the whole being constructed and enclosed in the tube or case, as described.

2. Water-wheel; Benjamin Billings, Macedon, New York.

Claim—The conical crown and conical wheel, constructed in the manner specified.

3. Cotton Harvesters; Lewis Bishop, Talladega, Alabama.

Claim—The endless picker chains placed on the cylinder in connexion with the brush cylinder, the above parts being attached to a cart or to a box or receptacle mounted on wheels, as set forth.

4. Hook for Whiffle-trees; Snowball Botterill, Westmoreland, New York.

Claim—The combination and arrangement of hooks and spring button, in the manner set forth.

5. Wind Engine; Henry W. Bowen, Providence, Rhode Island.

Claim—The frame provided with sails and attached to the shaft, in connexion with the bent lever connected with the sails by the rods and arms, the links, spring rod, and the weight and spring, or their equivalents, arranged as set forth.

6. Washing Machine; Robert Brown, Stroudsburg, Pennsylvania.

Claim—The arrangement in the trough of the chambers and transverse strips with the bars, when the chambers stand behind the strips, and the strips are placed in such a relation to the bars that they will pass between them, and thus at the same time press and rub the clothes.

7. Harvesting Machines; Thomas B. Butler, Norwalk, Connecticut.

Claim—The employment of the cams and guides, for the purpose of giving a forward and backward motion to the cutter bar and cutters.

8. Method of Reducing Wood, &c., to Sawdust or Finer Grains; W. J. Cantelo, Burlington, New Jersey.

Claim—Reducing glutinous, fibrous, and other tough materials, to powder, by placing the ends of blocks of the same opposite to and in contact with each other, and presenting them simultaneously, and at the point of junction, to the edge of a circular or reciprocating saw, with the aid of the appliances described.

9. Machinery for Webbing Single Strands of Thread; Michel Celerier, Philadelphia, Pennsylvania.

Claim—The combination of the pulley, the sliding car, the fork, and the eye-piece, arranged as described, for preparing silk for making twist.

10. Wrought Nail Machine; Charles Clareni, City of New York.

Claim—The combination of the top and side hammers and vibratory anvil, so as to form two or more nails at a time without turning the rod. Also, the apparatus for connecting the driving shaft with the top hammer, by which it receives its motion in a proper manner. Also, the connexion of the side hammers with the driving shaft to produce the requisite motions thereof, and allow said hammers to be raised and lowered. Also, the arrangement and operation of the cutter, as described, for severing the nail from the rod.

11. Ploughs; Isaac Cook and John T. Bever, Haynesville, Missouri.

Claim—The combination and arrangement of the sharp-edged land side wheel with a reversible, double-pointed mould-board, which has no land side bars, as set forth.

12. Steam Engines; George H. Corliss, Providence, Rhode Island.

Claim—Imparting to the liberated slide valves of steam engines their closing movements by springs, so connected with the valve gear that whilst these springs impart the same initial force to the valves at every operation, the expansive force which these springs exert varies with every change in the range of movement given to the valves. Also, imparting to the liberated slide valves of steam engines their closing movements, by springs combined with a curved moving support, in such manner that the spring applies itself tangentially to the said support, and the effective length of the spring varies with the tensive force which it exerts.

13. Method of Opening and Closing Farm Gates; B. M. Dorr, Kenawee, Illinois.

Claim—The arrangement of the pinion, the toothed racks, and the levers, to operate in combination with the slotted rods, and the crank levers, for the purpose of opening and closing the gate.

14. Water-proof Paints; Epos E. and Joseph F. Ellery, City of New York.

Claim—The composition prepared and composed of the materials, as described, in the proportions set forth, for the purpose of making water-proof paint.

15. Mills for Crushing Cane; H. C. Emery, Lincoln, Ohio.

Claim—The adjustable shafts of the rollers in slide bearings, at top and bottom, operating them in a rectilinear frame in a direct manner for giving a wedge pressure, providing them near their top with flanches and a groove and a bevel on their bottoms, from the periphery toward the shafts, the several parts standing in the relation to each other, as specified.

16. Lamps; A. L. Fleury, Baltimore, Maryland.

Claim—1st, The quick-lime cones, or their equivalents, arranged as described. 2d, In combination with the above, the flanched cap, as described.

17. Machine for Finishing the Exterior of Rims of Carriage Wheels; Reuben Fretz, Montville, Ohio.

Claim—Combining in the arm that gauges the plane, devices for varying the height of the radial arm with the devices for varying its length, so as to enable the operator to dress a wheel straight or square across the edge. Also, making the arm or bar which guides the plane in the arc of a circle, to vibrate in the stock, so as to adjust and fasten it in the position desired.

18. Cut-off Gear for Steam Engines; P. W. Gates, D. R. Frazer, and T. Chalmers, Chicago, Illinois.

Claim—The combination of the two levers, D D′, and their dogs, the lever or levers, C, and its or their teeth, and the eccentric curved plate or plates, the whole applied to the stem or stems of the valve or valves, to operate as set forth. Also, in combination with the said levers, teeth, and dogs, and the eccentric curved plate or plates of the arm on the valve stem, and the spring or stationary curved surface, applied and operating as specified.

19. Machine for Cutting Ends of Billiard Cues True; Ira Glynn and Mikel Borowsky, Placerville, Cal.

Claim—The application of the reversed knife or cutter, and the spring jaws for holding the cue, so as it can be cut off square for the leather—these jaws will open or close to suit the size of the cues.

20. Painting Press; George P. Gordon, City of New York.

Claim—1st, Taking the sheet from the feed-board by grippers, or their equivalents, and presenting it directly to or upon the form of types, thence conveying it to the place of impression so that it may be printed. 2d, The combination of a reciprocating bed with a set of sheet-receiving grippers, so that the movements of the bed may control the action of the grippers, in order that the sheet may be taken from the place of feeding

to the place of printing by such grippers. 3d. The combination of a vibrating platen, having a stationary or fixed axis upon which to vibrate, with a reciprocating bed. 4th, The combination of a set of sheet-piling grippers which will peel or take the printed sheet from the face of the type and pile it on its place of deposit, with a reciprocating bed. 5th, By use of automatic grippers, piling the sheets directly before or in front of, and under the eye of the operator, so that he may at once detect any imperfection in the impression. 6th, The combination in one and the same machine of a set of grippers, to take the sheet and carry it to the place of printing, with another set of grippers to take the sheet from the form and pile it. 7th, The arrangement and construction of a chase, as described, in combination with the piling grippers. 8th, The giving a reciprocating vibratory motion to a bed or carriage, allowing the necessary intervals of time for the purpose of receiving the sheet or the impression, either or both of them, by means of the cam forming part of the bed, the cranked shaft, the vibrating arm, and the connecting rod, or their equivalents.

21. Paddle-wheel; William Gorman, City of New York.

Claim—The sliding paddles or floats placed between the traverse bars of the arms of the wheel, and arranged with the catches and stationary cam, or their equivalents, to operate as set forth.

22. Corn Huskers; S. N. Gragg, Shelburne Falls, Massachusetts.

Claim—The curved or convex rest, in combination with the reciprocating knife, arranged as described.

23. Sewing Machines; William Grout, Worcester, Massachusetts.

Claim—1st, The arrangement of the feeding bar, needle, and looper, in the manner described, so that the movement of the cloth shall aid in extending the looper thread and in tightening the needle thread, and this when the needle is out of the cloth. 2d, The arrangement of the looper and forceps, so that the forceps shall draw the loop of the needle thread across the path of the looper, and in line with the movement of the cloth. 3d, The combination of the needle and looper, when arranged so that both shall reciprocate in straight lines, and also so that by merely changing the length of the looper a single or double stitch may be formed, in the manner described.

24. Abdominal Supporters; Benjamin A. Grover, Momence, Illinois.

Claim—1st, Constructing an adjustable spring steel frame, of the form described, by combining, arranging, and securing together a series of spring bars, in the manner described. 2d. Covering the concave portion of said frame with a canvass, or other cloth, whose edge or border is gathered and drawn together over the outside edges of the said spring frame, by an india rubber or other elastic cord, so as to give the covering portion of said canvass, or other cloth, the character of an elastic cushion, no matter what may be the extent of the contraction or expansion of the spring frame. 3d. Attaching the upper and lower straps which respectively branch upward and downward from the band of the main strap at the points of the spring frame, and in the relation to each other and the centre or main straps, so as to give an upward pressure to the spring frame, and for other purposes set forth.

25. Horse Rakes; Elijah Harris, Princeton, Illinois.

Claim—The levers with the arms and the projection or finger, in combination with the stop, as set forth.

26. Door Fastening; W. Hartsfield, Thomaston, Georgia.

Claim—The arrangement of the bar which is attached to the inside of a door, to operate in combination with the staple, and with the bolt and spring, as described.

27. Machine for Boring; Henry Hays, City of New York.

Claim—The arrangement of the adjustable head blocks, carrying the spindles of the boring tools, when combined with the spring-tightening pulley, in the manner specified.

28. Stoves; John Henderson, Horseheads, New York.

Claim—The construction and arrangement of the ventilating passages and concealed flues, the former having their origin in the heating chamber, and terminating at or near the top of the oven, and the latter starting from the lower part thereof, and terminating in the flue, whereby external air is admitted, and currents thereof passed through the oven.

29. Construction of Sheet Metal Coffins; Isaac C. Shuler, Amsterdam, New York.

Claim—1st, The arrangement of stiffening the lower part of a sheet metal coffin by locking together the scrolled edges of the sides and bottom, forming a firm rim when they are soldered together. 2d, The sheet metal rim, c, on the outside of the walls, as a means of stiffening the base either with or without a filling of molten metal, according to the size of the coffin. 3d, The rim, d, of sheet metal, single or scrolled, forming an inside chamber, which may be filled with molten metal or left hollow, according to the size of the coffin. 4th, A cast metal rim, f, with a deep groove on the under side, which receives, straightens, and stiffens the walls, and which serves to support the lids. 5th, Setting the pillows or braces, x, at the corners and around the body of the coffin between the inward projections of the rims, d and f, which give them an extended purchase, for the purpose of stiffening the walls; also, the peculiar braces, E, to prevent the lateral racking of the bottom. 6th, The arrangement of pressing inverted beads or recesses, in any required number, in the sheet metal of the lid, walls, and bottom of a metal coffin on the inside and on the outside of the same, which may be filled with molten metal in the large size, and left empty in the small size coffins, for the purpose of securing, by a peculiar mode of manufacture, of a level surface between the indented parts described. 7th, The arrangement of fastening firmly on the under side, near the outer edge of the air-tight lid of a sheet metal coffin, a cast metal rim, or its equivalent, for the purpose of strengthening this lid, and also for fitting into the groove in the rim, F, on the upper edge of the walls of the coffin. 8th, The arrangement of fastening around the face-window on the under side of the air-tight lid of a sheet metal coffin, a cast metal sash or rim, m, which receives and supports the face-glass when it is cemented in its proper place. 9th, The arrangement of fastening permanently, on the under side near the outer edge of the sheet metal blind, m, which covers the glass in the face-window of a sheet metal coffin, a cast metal brim, o, or its equivalent, for the purpose of strengthening and furnishing a means of securing the same to the outer lid which covers the air-tight joint. 10th, The arrangement described of two entire, distinct, separate sheet metal lids.

30. Butter Cooler; G. W. Smith, Hartford, Connecticut.

Claim—The arrangement of the air-tight ice chamber, in combination with the butter-plate and with the cup, as set forth.

31. Device for Heating Steam Boilers; Daniel Hess, Uniontown, Iowa.

Claim—1st, The combination with a steam boiler of the tight external casing and fan, for the purpose of producing currents of air around the boiler. 2d, In combination with the subject of the first claim, the stove provided with a smoke-pipe through which the products of combustion pass, while the heat passes into the casing.

32. AUTOMATIC FAN; Hervey Hoffman, City of New York.

Claim—The arrangement of the rock shaft, arms, bells, and rollers, or the equivalents, to operate in combination with the fan-carrier.

33. RAILROAD CHAIRS; Isaac B. Howe, Northfield, Vermont.

Claim—The one-lip chair, secured by the single bolt, in combination with the permanent fishing piece, arranged and operating in the manner set forth.

34. MANUFACTURING WADDING; Julius C. Hurd and Moses A. Johnson, Dorchester, Massachusetts.

Claim—The described wadding, having its two surfaces felted, as set forth.

35. MOWING MACHINES; Obed Hussey, Baltimore, Maryland.

Claim—In combination with the ordinary apparatus fixed to the extreme end of the finger beam, and called a track clearer, a similar apparatus at the opposite or frame end of said beam, when so arranged as to sweep the cut grass towards the centre of the swath, and leave it in a windrow behind the machine.

36. MACHINE FOR TURNING OVALS; Joshua Irving, City of New York.

Claim—The sliding disc and driving rim combined with the centre mandrel and slides.

37. HORSE-SHOE; Joseph Jorey, Rocky Hill, Connecticut.

Claim—The combination of the plate, corks, and shoe, in the manner described.

38. CULTIVATORS; Philip Kribs, Jefferson Furnace, Pennsylvania.

Claim—The arrangement of the bars, A B C, metal frame, handles, shanks, teeth, bar, I, and shafts, as described.

39. HORSE RAKES; Philip Lebzetter, Lancaster, Pennsylvania.

Claim—The double axle, brace, and sliding bands, hinged braces, slot-hook and staple, binding screw, hinged rod, and beam, combined in the manner specified.

40. VAULT DOORS AND CAST IRON SAFES; Lewis Lillie, Troy, New York.

Claim—The arrangement and combination of a series of pipes or tubes, and the filling of the same with cast steel hardened, or with refined cast iron, as described.

41. DOOR-KNOB BOLT; Lewis Lillie, Troy, New York.

Claim—The knob-bolt or spindle, constructed in the manner described. Further, the switch and the nut, arranged and fastened to and upon the knob-bolt or spindle, in the manner as set forth.

42. TRUNKS; Matthias Ludlum, Fair Haven, Vermont.

Claim—The combination with a water-tight shell or body part to a trunk or box, having ordinary or any other suitable inner and outer lids of a valvular spring borne lid of water-tight construction, and arranged to occupy an immediate position in relation to the inner and outer or ordinary lids, essentially as set forth.

43. BUCKLES; Thomas P. Marshall, Trenton, New Jersey.

Claim—A buckle, constructed of a sliding case with the platform and slot, in combination with the nose, and otherwise arranged as set forth.

44. ROTARY PUMPS; Jarrett Megaw, Wilmington, Delaware.

Claim—Combining the water-packing chambers formed around the axes or shaft, between the suction pipe and stuffing-boxes, with the descending main or discharge pipe of the pumps.

45. RAILROAD CAR COUPLINGS; Richard L. Mills and Paul Carpenter, Lancaster, Ohio.

Claim—The arrangement of the sliding frame and vibrating frame, in combination with the flat locking key, constructed as set forth.

46. MACHINES FOR PLANTING COTTON SEED; Z. N. Morrel, Cameron, Texas.

Claim—1st, The combination and arrangement of the one side-wheel, cylinder, stirrer, gear wheels, mortised beam, share, and boot, as described. 2d, The arrangement of the V-shaped fender with the harrow teeth, and with the devices included on the first claim.

47. ELASTIC FRICTION ROLLER; A. A. Moss, Philadelphia, Pennsylvania.

Claim—The elastic friction apparatus described, the same consisting of the ball or sphere, spring, and case or hole, arranged in relation to each other in the manner described, irrespectively of the plate or the conical form of the spiral spring.

48. PIN-STICKING MACHINE; J. W. Naramore, Derby, Connecticut.

Claim—1st, Operating the driver or drivers and the crimping and feeding apparatus, or any portion of the same, by means of a clutch or clutches, carried by a constantly rotating shaft, and thrown into gear therewith, to effect such operation by the action of the sliding bed or pin-carriage as the latter, after having received the pins, completes its movement to the necessary position for the sticking operation. 2d, The combination with a single reciprocating sliding bed or pin-carriage and a single conductor, of two drivers, and two sets of crimping and paper-feeding apparatus, arranged on opposite sides of the mouth of the conductor in such a manner that the said bed or carriage, in every movement in either direction, is caused to be filled with pins from the conductor, and to convey them to a proper position relatively to one or the other of the drivers, to be thereby driven into the paper supplied, and crimped by its respective feeding and crimping apparatus, whereby I effect a saving of the time heretofore lost in running the bed twice under the conductor to be once filled. 3d, Effecting the combination between the sliding bed or carriage and a clutch, carried by a constantly revolving shaft, to operate a driver, a crimper, and a feeding apparatus, or either of them, by means of a toothed lever, a spring, notched slide, or plate, with an inclined edge and a sliding tooth, the whole applied and operating to permit one, and only one, revolution of the loose portion of the clutch, and hence but a single operation of the part or parts driven by it.

49. HAND PRINTING PRESSES; A. and B. Newbury, Windham Centre, New York.

Claim—The arrangement and combination of the slotted frame, adjustable bar, platen, roller frame, and rotating ink table, as described.

50. FLOUR-BOLTS; Ellis and Addison H. Nordyke, Richmond, Indiana.

Claim—1st, The band encircling the shaft, in combination with the spring catches, for the purpose described. 2d, Making the movable slide in two parts, jointed, as set forth.

51. Clover-hullers; Anthony Overocker, McHenry, Illinois.

Claim—The combination of the concave and cylinder with the adjustable sliding door, in the manner described.

52. Manufacture of Hoes; Andrew Paterson. Birmingham, Pennsylvania.

Claim—The combination of the two jaws which clasp the blade with the head and the blade, arranged as set forth.

53. Piano Hammers; John Percival, Auburn, New York.

Claim—Constructing and arranging the cushion forming the elastic covering to the hammer-head, as described.

54. Setting Gas Metres in the Walls of Buildings; Albert Potts, Philadelphia, Pennsylvania.

Claim—The manner described of adjusting a gas metre to an auxiliary case of the character specified, so that the matter is applied to a building in a neat and a secure manner, and, at the same time, the examination of the same, to ascertain its condition or the amount of gas consumed, from the outside of the building, is rendered practicable and convenient.

55. Mode of Regulating the Exhaust in Locomotive Engines; Thomas B. Quigley, Galion, Ohio.

Claim—1st, The sliding throttle-valves, when combined with the exhaust pipes of a locomotive engine, in the manner specified. 2d, The sliding-box with apertures, in combination with the chest, as set forth.

56. Apparatus for Punching Stereotype Plates; D. B. Ray, Galena, Illinois.

Claim—The arrangement of stamping bars, D, upon A B, when provided with the characters to be printed or stereotyped, so that they will all work to a common centre, and imprint the characters upon the face of the type-metal, in the manner set forth. Also, arranging upon the end of bar, F, knives, for the purposes specified.

57. Trunnion Box-lining for Oscillating Engines; John A. Reed, Jersey City, New Jersey.

Claim—The employment, in combination with the conical trunnions of slit cap-like linings, applied to the boxes with screws and nuts, or other equivalent means of forcing them up towards the sides of the cylinder, as described.

58. Elastic Railroad Frogs; George P. Sanburn and Willis Mansfield, New Haven, Connecticut.

Claim—An elastic frog, constructed of layers of plate metal and wood, in the manner specified, and either with or without layers of vulcanized rubber. Also, constructing an elastic frog with end slots, suitable to receive the lower flanch and neck of a rail, as specified, whereby the frog may be kept in alignment.

59. Protecting Surfaces of Articles of Iron; Thaddeus Selleck, Greenwich, Connecticut.

Claim—A horse-shoe, or other article, as indicated, made by uniting Franklinite pig-metal with the surface of iron, as set forth.

60. Revolving Fire Arms; Horace Smith and D. B. Wesson, Springfield, Massachusetts.

Claim—The wedge on the top of the nose of the hammer, the spring, and stop-bolt, when combined for the purpose and operating in the manner described.

61. Ironing-pan for Ranges or Stoves; James Spear, Philadelphia, Pennsylvania.

Claim—An ironing-pan, constructed with a perforated bottom, in the manner described.

62. Picker-motion for Power Looms; Wm. Steams, Manchester, New Hampshire.

Claim—Extending the picker-staff down through and below the rocker, and through the rail. Also, the rocker, made to receive the staff, in the way and manner described. Also, in combination with the rocker, the hook, whether made separate or cast on the rocker, for the purposes set forth. Also, making the picker-staff adjustable in the rocker, in the manner described, or in some equivalent manner. Also, making the stud surrounded by the coiled spring, smaller in the middle than at the ends, to allow the spring to contract in diameter in the middle as it is drawn in working. Also, making that portion of the stud surrounded by the stationary end of the coiled spring permanent or stationary, and that portion surrounded by the moving end of the spring to revolve, to facilitate the working of the spring.

63. Scales for Weighing; Joseph W. Strange, Bangor, Maine.

Claim—1st, Arranging the beam in such a manner that the several indications or scales marked on the same, can be brought before the eye of the operator, by turning the beam. 2d, The arrangement of the socket, so that its end forms the common index-pointer for the several indications marked on the sides of the beam, as specified.

64. Gas Retorts; William Stratton, Philadelphia, Pennsylvania.

Claim—The employment of an upright partition dividing the retort into chambers, in the manner set forth.

65. Photographic Cameras; John Stock, City of New York.

Claim—1st, The arrangement of the front plate of a camera, to which the lens-tube is attached in such a manner that the centre of the tube may be moved in any desired position, for the purpose and in the manner specified. 2d, The arrangements of the plates, 5 and 8, for the purpose described. 3d, Attaching the ground glass-holder to the end of the camera, and the manner of supporting the weight of the same, as specified.

66. Cotton and Hay Presses; Elam Stockbridge, Houston, Texas.

Claim—The arrangement, in combination with the horizontal ropes or chains, vertical windlass, horizontal toggles, and horizontal follower of the auxiliary horizontal ropes or chains, in the manner set forth.

67. Churn; Josiah Stubbs, Dublin, Indiana.

Claim—Operating the butterfly wings with the single crank confined to one side of the cylinder, being made to cross the body of the cylinder obliquely to effect this movement, in the manner set forth.

68. Mercurial Barometers; Guiseppe Tagliabue, City of New York.

Claim—The external slotted sleeve gauge, applied in combination with the cistern or lower limb of the barometer, and with the adjustable scale, as described.

69. Bagasse Furnaces; Louis Tregre, of the Parish of St. John the Baptist, Louisiana.

Claim—The employment of a double feeder, arranged with springs through the blades of the lower

feeder to allow the hot air from the furnace to pass from the lower feeder to the upper feeder, for the purpose set forth. Also, arranging between the two feeders an intermediate chamber to receive and retain the bagasse as it passes from the upper to the lower feeder, and constructing the upper feeder of larger size than the lower feeder, with or without an increased number of blades, or in an equivalent manner. Further, introducing an independent current of hot, dry air into the chamber, between the two feeders.

70. Head-block for Saw-mills; Jacob W. Truox, Richford, Vermont.

Claim—1st, The combination and arrangement of the ratchet-wheel, setting lever, cam wheel, gauge wheel, and spur-wheel, with the spring-latch, in the manner specified. 2d, The clamps, the lever, and eccentric lever, arranged as specified.

71. Spring-snap for Bridle-reins; Marianus X. Tschus, Bloomington, Illinois.

Claim—The combination of the two in one, in the manner described.

72. Cast Iron Tires for Railroad Wheels; Levi B. Tyng, Lowell, Massachusetts.

Claim—1st, The wedge-shaped braces, arranged in the chamber between the rims of a hollow cast iron tire, so that the chamber is continuous throughout. 2d, In combination with the continuous chamber, I claim the groove in the inner rim, arranged as described. 3d, Arranging the ribs alternately on the inner and outer rim, for the purpose of strengthening them without tying them together, as described.

[This inventor has solved the question, to construct hollow chilled cast iron tire for railroad wheels, in such a manner that they combine lightness and durability.]

73. Mode of Propelling Locomotive Engines on Railroads; Wm. W. Virdin, Baltimore, Maryland.

Claim—The placing of the friction wheels under the driving wheels of locomotives, or other vehicles, in the manner described.

74. Mode of Braking Locomotive Engines on Railroads; Wm. W. Virdin, Baltimore, Maryland.

Claim—The introduction of air into the cylinders of locomotives, in manner as set forth, and for the purpose of offering a yielding resistance to the movement of the piston, and by this resistance overcome the momentum of the train.

75. Ring and Traveler Spinning Machines; Joseph W. Wattles, Canton, Massachusetts.

Claim—The combination and arrangement of the bearing annulus with the ring or its traveler-carrier, in the manner and to operate with the traveler, as described.

76. Machine for Boring Post-holes in the Earth; John S. Wertz, Middletown, Iowa.

Claim—1st, The arrangement and combination of the screw-shaft, cross-head, grooves, pinion, and toothed cylinders, B, as described. 2d, The arrangement and combination with the cylinders, B, of the shaft, F, and rotary scrapers, as described. 3d, The arrangement and combination with the frame of the jointed bars, sectors, and adjusting rods, as described.

[Two toothed cylinders and an auger are used in this invention, in connexion with rotating clearers and an adjustable framing, so that post-holes may be sunk in the earth by horse or other power, very expeditiously.]

77. Corn Planters; J. W. West, Hillsboro', Ohio.

Claim—The arrangement of cords, with the pulleys working in arms for operating the slotted plunger and seeding bar, in the manner set forth.

78. Manufacturing Machine and Animal Cards; William Wheeler, West Poultney, Vermont.

Claim—The construction and arrangement of the sheet metal backs and wire-teeth, in combination, as described, when united by solder applied thereto, by immersion or otherwise.

79. Alarm Attachment for Tills; E. B. White, Nashua, New Hampshire.

Claim—1st, The bolt-plate provided with bolts connected by a joint to the box, and connected to a bell-striking apparatus, in connexion with the keys and a stop applied to the till, as set forth. 2d, In combination with the bolt-plate, bolt, and keys, the bars and screws in the parts of the keys, when the bolt-plate and bar are both connected with the lever on the bell-striking apparatus in any proper way. 3d, The employment or use of the sliding plate, combined and arranged with the bolt-plate and stop, to operate automatically. 4th, The employment or use of a supplemental spring fitted in a socket, or otherwise arranged to resist the movement of the bar, when said bar is used in connexion with spring bolts, as described.

80. Churn; Loren J. Wicks, Racine, Wisconsin.

Claim—1st, The combination of the box, A, the pipe, and the box, C, when the same are used in the manner set forth. 2d, Placing the box, C, over the box, A, and providing said box, C, with a screen and depending wire gauze partitions, in the manner specified.

81. Corn Planters; Henry Wiley, Frankfort, Ohio.

Claim—The arrangement of the gate, wheel, bars, hopper, rods, slides, and seed tubes, all constructed and operated as set forth.

82. Machine for Boring or Mortising Blind Stiles; Leonard Worcester, Lebanon, New Hampshire.

Claim—Combining the transversely reciprocating carriages, A A, with the cam cylinders, by means of the pairs of vibrating levers, in the manner set forth. Also, the notched plates for sustaining the stiles during the operation of mortising or boring the same, when the said plates are combined with reciprocating bearings, and other suitable mechanism, in such a manner that the necessary laterally reciprocating, and longitudinally feeding movements will be imparted to said plates. Also, combining the bearings of the bit-shaft with the reciprocating carriage, C, when the said shaft is so arranged with relation to the notched plates that the bits which project from the ends of said shaft will act upon the stiles as they are automatically presented to them. Also, the combination and joint operation with each other of the reciprocating carriages, A A, the notched plates, the pairs of levers, the cam cylinders, the reciprocating spring pawls, and the bit-carrying cylinder.

83. Corrugating Sheet Metal; W. E. Worthen and H. B. Renwick, City of New York.

Claim—The method of corrugating or moulding sheet metal by several dies acting in succession, in the manner specified, upon a sheet resting upon a bed, die, or dies, so as to cause the metal to conform to shape.

84. Self-acting Spinning Mules; John Wright, Worcester, Massachusetts.

Claim—The shaft with its screw-thread, arranged and applied as described, in combination with the carriage, the quadrant, and the shaft which drives the drawing rollers.

85. MANUFACTURING CORRUGATED FABRICS; Frederick Baare and J. G. Cawelly, Assignors to H. H. Day, City of New York.

Claim—The combination of two or more parallel series of corrugations in the same fabric, in such manner that the ridges of the adjacent series alternate. Also, combining rubber strands (one or more) with a textile material, in such manner that when the rubber contracts, the compound fabric gathers up into two or more parallel series of corrugations whose numbers alternate. Also, combining rubber strands with a textile material, in such manner that the strands are alternately secured to the fabric and left free therefrom at alternating parts of their length, so that the secured parts of one rubber strand corresponds with the free part of an adjacent one. Also, forming the fabric sleazy, at the division lines between the corrugations of adjacent series, so as to insure uniformity in the form of the adjacent extremities of the corrugations.

86. GAUGE COCKS FOR STEAM BOILERS; F. W. Bacon, West Newton, Assignor to E. H. Ashcroft, Boston, Mass.

Claim—The combination of the throat-clearer with the throat and the screw-plug gauge cock, and so as to operate therewith, as specified.

87. VULCANIZED RUBBER CAR SPRINGS; H. W. Beins, Assignor to the New England Car Spring Co., City of New York.

Claim—The sectional gum car spring of two or more pieces, vulcanized in the manner set forth.

88. IRONING TABLE AND CLOTHES DRYER; E. Culver, Assignor to self and R. N. Fife, Shelburne Falls, Mass.

Claim—The described combination of ironing table and clothes dryer, the table furnishing a support to the dryer, and a receptacle in which it may by stowed away.

89. VULCANIZING RUBBER; A. K. Eaton, City of New York, Assignor (through G. S. L. Cummins, et al.,) to the Joslin India Rubber Company.

Claim—The use of the sulphide of manganese in the curing of india rubber, in the manner specified.

90. RAILROAD BRAKES; O. F. Fuller, Lamonte, Assignor to self and W. M. Ferry, Ferrysburg, Michigan.

Claim—The brake blocks, pins, and levers, constructed and operating together as described.

91. SUGAR MILLS; J. R. Gates, Assignor to self, G. G. Dumont, and E. F. Sinker, Indianapols, Indiana.

Claim—The grooved friction rollers, when used for stripping the blade from the stalk, as set forth.

92. BUTTER-WORKER; Joseph Jones, Assignor to self and James G. Bryce, Philadelphia, Pennsylvania.

Claim—The use of the yielding beater, whether solid or constructed with an open or with a perforated bottom, enclosing an absorbing material, in combination with a traveling tray, as described.

93. MANUFACTURING BASKETS; Lansing Marble, Assignor to self and T. North, Vassar, Michigan.

Claim—The described method of forming baskets by passing a series of staves or splints through proper guides over a mould, and pressing the same in the proper shape by a suitable piston and form, as set forth.

[By the aid of this machine baskets can be formed with less labor and stronger than by hand, all the staves or splints being kept in the proper places by guides until they are fastened, and the baskets being strengthened by hoops.]

94. HARVESTERS; Lewis and Jacob Miller, Assignors to C. Aultman & Co., Canton, Ohio.

Claim—Extending the finger or platform bar, one or both, far enough under the yielding bars, by which they are hung to the main frame, so that the two may be united by suspension rods, which allows them a yielding motion in one direction, and makes them rigid in another direction, and prevents the motions of the main frame from being communicated to the finger bar, as described.

95. MOULDING BEADS ON HOLLOW WARE; Charles Neale, Assignor to Frederick Leibrandt and W. L. McDowell, Philadelphia, Pennsylvania.

Claim—Moulding for the production of beads, flanches, or other projections and ornaments on the outer sides of cast metal pots, kettles, and other vessels, so as to form the said vessels in two part-flasks, the pattern bed flanch, or other projecting ornament, being so constructed, arranged, and operated as to admit of its being drawn in and pushed out of the vessel pattern.

96. HAWSE PIPE FOR SHIPS; A. S. Philips, Boston, Assignor to self and Isaac Adams, South Boston, Mass.
Claim—A tubular cable guide curved, as described.

97. CORN PLANTERS; Peter Plater, Assignor to self and J. S. Fleming, Moore's Hill, Indiana.

Claim—The arrangement of the shield, hammer, sliding feed bar, lever, crank shaft, and spring, the whole being constructed as set forth.

98. THRESHING MACHINES; John I. Rollow, Assignor to Charles C. Wellford, Fredericksburgh, Virginia.

Claim—The combination of the inclined carrier with the shoot and curved screen, the whole being constructed as set forth.

99. MACHINE FOR POINTING NAILS AND SPIKES; Wm. Spink, Assignor to Oliver A. Washburn, Jr., Providence, Rhode Island.

Claim—The combination of the hunter, the pointer, and the spring with each other, and with the back piece and other parts of the reed machine, or with the corresponding parts of any other nail machines, constructed in the manner described.

100. MACHINE FOR WASHING AND AMALGAMATING GOLD; George C. Wheeler, Graysville, Georgia, Assignor to self and George Calvert, Upperville, Virginia.

Claim—1st, The relative arrangement for united operation of the hopper, horizontally revolving vertical tubes, horizontally revolving rakes, and stationary washing vessels, B C. 2d, Making the receiver or washing vessel in two parts, B C, and combining with the part, C, an adjusting device, D, as described.

101. DEVICE FOR OPERATING THE CUT-OFF VALVE OF STEAM ENGINES; W. W. W. Wood and Henry Hewson, Assignors to John Rice, Philadelphia, Pennsylvania.

Claim—We limit our claim to causing the positive power of the engine to operate the throttle valve, by the employment of two vibrating, reciprocating, or rotating strikers, actuated by any positive movement of the engine, in combination with two inclined planes intervening between the said strikers, and the valve or appliances connected therewith, any governor being so connected to the strikers or to the inclined planes, that the movement of the governor caused by any increase or diminution in the speed of the engine, shall change the position of the inclined planes in respect to the striking, or that of the strikers in respect to the inclined planes, and that the latter may thereby be the intermediate means of regulating the extent of the opening of the valve to suit the speed of the engine while the actual movement of the valve is effected through one or the other of the strikers by the power of the engine itself, as set forth.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On Embroidery by Machinery.** By George Wallis.

The object of this paper is simply to give a popular description of the leading features of the embroidering machine, and to illustrate its practical use and capabilities by specimens of textile decoration produced by it. A full and complete description of this machine would involve either the presence of a machine in full work, or such a series of elaborate drawings, diagrams, or models, as would render the task of description neither pleasant nor profitable. No attempt, therefore, will be made to do more than simplify the principle upon which the machine is constructed, and give such illustrations of its action and capabilities as may serve to show its superiority over, or indicate its inferiority to, the human hand in the production of embroidered effects. The diagrams used will be such simplifications of construction as will be best calculated to render that construction intelligible, and are in no way intended as illustrations of the complete mechanical structure of the parts described, or of their full action.

As an interesting branch of art-industry, embroidery by machinery is more wondered at than understood, and it is no uncommon thing to find the mechanical agent used in its production confounded with the various sewing machines which have recently come so largely into use for a variety of purposes. Machine embroidery may, as it did some ten or twelve years ago, stimulate the productions of hand embroidery, and to a certain extent, supplement them, but it is doubtful, to say the least, if it can ever supplant them. Excelling hand embroidery in accuracy of repetition, and in the production of the same design on both sides of the fabric decorated, it is limited in its range, alike as regards subject and the article to which it can be applied.

In variety of effect it can never compete with hand embroidery, and, although, as in the dress embroidered for Her Majesty, by the late Mr. Louis Schwabe of Manchester, the effects of the original drawing are given in all their variety, this has only been done at a great sacrifice of all the economic powers of the machine. When Mr. Schwabe first showed me this specimen in 1844, he said, "I was written to and asked if my machines would execute any design? I replied that any design which Her Majesty wished executed should be produced by them. When the drawing came I saw the mistake I had made, but resolved, cost what it might, that the work should be done and there it is." As an illustration of what can be done by the embroidering machine, the example is interesting, but as an illustration of its economic use, or its superiority over hand embroidery, it is worthless.

Having said thus much as to the true purposes of machinery as applied to embroidery, it may be useful to make a few introductory remarks on the subject of embroidery as an art of so ancient a character, that its origin is entirely lost.

* From the Jour. of the Society of Arts, No. 333.

The early history of embroidery is associated with the progress of civilization and refinement as an elegant employment for females; and one which, from a remote antiquity, exercised a large and abiding influence on ornamental art. It is the most primitive mode of textile decoration, and ranges at once from the simplest figure to the most intricate elaborations of a variety of materials requiring the skill of the needle-woman, with the invention of the ornamentalist. It is practised in one form or another wherever man has made any advance beyond the rude art of ornamenting his body by tatooing. The wonderful embroidery of the Peruvians, which so astonished their Spanish invaders, displayed surprising effects of color produced by the plumage of tropical birds, combined with threads of gold and silver. In all periods of the world's history, among the richest specimens of ornament dedicated to the service of ceremonial religion, we always find embroidery. In the Mosaic Tabernacle the embroidery of purple, blue, and scarlet was conspicuous, and the elaborate embroidery of sacerdotal vestments, especially those of the high priest, show how largely this sacrificial ornamental work was used in the early ceremonials of the Jews.

In the last chapter of the Proverbs of Solomon is an interesting picture of the virtuous wife, whose "Lamp goeth not out by night," and who "worketh beautiful vestments for herself,"—

> Her clothing is fine linen and purple.
> Her husband is known in the gates,
> When he sitteth among the elders of the land.
> She maketh him fine linen and selleth it;
> And delivereth girdles unto the merchant.
>
> Verses 22, 23, 24.

In the prophecy, by Ezekiel, embroidery is mentioned as the clothing of Jerusalem, represented under the figure of a woman.

> "I clothed thee also with embroidered work."
>
> Chap. 16; verse 10.
>
> "Thou wast decked with gold and silver;
> And thy raiment was of fine linen and silk and embroidered work."
>
> Verse 13.

The Egyptians used embroidery to a very great extent. The sails of their boats were of embroidered linen, and the wrappings of their dead were frequently thus decorated.

The Greeks attributed the invention to Minerva. Homer describes two of his heroines as engaged in embroidery—Helen, as depicting the combats of the Trojan war, and Andromache,—

> "In the chamber at the palace top,
> A splendid texture wrought on either side,
> All dazzling bright, with flowers of various hues."

The women of Sidon are said to have been noted for their skill in embroidery even before the Trojan war. Pliny attributes its invention to the Phrygians, hence the Roman name for embroidered garments,—*Vestes Phrygioniæ.*

It should be understood, however, that the word signifying "embroidery" is used by ancient writers as a generic term for all kinds of decorative work done by the needle. In later periods, the sense

was limited to peculiar effects produced by certain fixed methods, and in more modern times a still greater limit is understood.

The practice of embroidery in Europe was very largely extended during the mediæval periods, and was carried to great perfection for the personal adornment of royalty, the nobility, and especially in the service of the church. The vestments of the priesthood, hangings, veils, canopies, curtains, and other textile articles of use and decoration, were largely embroidered; indeed, the character of the work of this period was chiefly ecclesiastical, and the inmates of convents employed their time in this direction with remarkable results. Some of the most valuable illustrations of the manners and costumes of past ages have come down to us through the agency of the needle; and in proof of this it will be sufficient here to allude to those interesting records in embroidered work and tapestry, as coverings for the walls of rooms, and hangings for doors, windows, and corridors, in the execution of which the ladies of noble families beguiled their leisure hours. Family traditions, historical incidents, portraits, the sports of the field, and groups of natural objects, were all employed in the execution of textile ornaments for the decoration of apartments. In England this art was carried to a high degree of perfection, and in the execution of vestments, English work was so highly prized as to have been constantly sent out to Rome by command of the Pope. There can be little doubt that the skill in embroidered work displayed by our ancestors was the forerunner of several of our most common kinds of ornamentation. Paper hangings, for instance, were originally professed imitations of tapestry, the patterns having been first printed on canvass.

Ancient embroidery is divisable into three heads:—"*Low*" embroidery, in which the threads are laid flat on the ground of the work: "*Raised*" embroidery, in which the figures are brought into relief, and rounded by means of wool, cotton, parchment, or paper placed beneath the needle-work: "*Gimped*" embroidery, in which the figures are formed by cords of gold, silver, or silk and portions of velvet or satin, gold and silk.

Hand embroidery is still extensively practised in the East. The true Indian and Persian scarfs are embroidery work of floss or untwisted silk, and exceedingly rich effects are thus produced, as will be remembered by those who examined the Indian productions of this class in the Great Exhibition of 1851.

In Turkey and Greece embroidery with gold and silver thread, or richly-colored cottons, silks and velvets, is much used for robes and decorations. The embroideries exhibited by Turkey, in the Great Exhibition of 1851, were of a marvellous character in execution, and deserved much more attention than it is to be feared they received. As commissioner of one of the groups of Juries, I had to direct attention to them, and in the midst of so much that was excellent, the difficulty lay in selecting those most worthy of reward. The articles embroidered were all made up for use as clothing, and the jury for that class had therefore to undertake the work of adjudication. Such

was the difficulty of selection, that the task was nearly abandoned in despair, and nothing but an urgent demand on my part that so remarkable a display should have full justice done to it, induced the jury to proceed. From the system adopted by the Turkish authorities in collecting and registering the works, some of the best had to be passed over, and the jury finally reported:—"It is impossible to recognise, either by medal or honorable mention, many of those to whom such distinctions are justly due, as no names are given whereby the jury can take cognizance of the articles. Those cases which the jury have been enabled to recognise are selected as much for the facility for giving such recognition, as for the high merit displayed in the production, inasmuch as there are others deserving of the same consideration, could the jury have discriminated amid the vast collection of articles." The awards are curious, and all to women, except a prize medal to the Tailors' Association of Janina for Albanian costumes. Whether the daughter of the Turkish gentleman with an unpronounceable name ever received the awarded medal, or the girls Bukudgy and Istche, or the wives of Carabet and Tetzy got information of the "honorable mention" made of their embroideries, is a matter of speculation to this hour with those who desired to do them justice.

Probably the finest modern examples of pure embroidery in silk, unmixed with gold and silver thread, pearls or precious stones, are executed by the Chinese. Not only in execution, but in design and the fitness of the forms of the ornament to the material and purpose, the embroideries of the Chinese generally exhibit a great superiority to the usual examples of European skill. The extreme care taken with the work, especially in the more costly specimens, renders them very instructive examples of textile decoration. From 700 to 750 stitches may be counted in the space of a square inch. Some years ago I took the trouble to dissect some of the best examples I could meet with, and the more closely they were examined the more marvellous the work appeared. Some diagrams now before you show the peculiarities of treatment, and illustrate in some degree the arrangement of the stitches.

Of course, the leading Continental nations are producers of embroidery, especially France, but the styles adopted are usually either a re-production of the ancient methods, or imitations of Eastern productions.

This brief sketch of the progress of embroidery by hand, must suffice to introduce the special subject before us,

EMBROIDERY BY MACHINERY.

This has been effected to a considerable extent by the Jacquard and Draw looms, or rather effects in imitation of embroidery have been produced. With this, however, we have nothing to do, as machine embroidery, by the legitimate means of the needle, is the point which it is desired to explain and illustrate.

The first idea of the embroidering machine originated with M. Josué Heilmann of Mulhouse. His object was to combine accuracy of repetition over a large surface with economy of production. Selling it to

Messrs. Koechlin, also of Mulhouse, he developed the principle of its construction in their establishment, where it was first practically applied to manufactures. The invention appears to have been first brought before the public in the National Exposition of the Products of Industry, at Paris in 1834; but the machine was patented for England about 1829, and with all rights, &c., purchased from Messrs. Koechlin by Mr. Henry Houldsworth, of Manchester, by whom it was subsequently very greatly improved from time to time. The first successful use of the machines as improved was in the silk manufactory of the late Mr. Louis Schwabe, in the then Portland-street Mill, Manchester; Mr. Houldsworth, having made an arrangement with Mr. Schwabe, as a manufacturer in whose trade their powers would find most development. Here they were employed in embroideries for upholsterers, but chiefly in the "sprigging" of waistcoatings, to which they were peculiarly adapted, as will be shown in the course of the illustrations of the construction and action of the machine.

The leading principle of the machine in the production of a pattern is that of the pantagraph, by which a given form is copied to a fixed scale, in this particular instance to one-sixth the size of the guiding pattern.

The machine may be divided into *three* parts:—

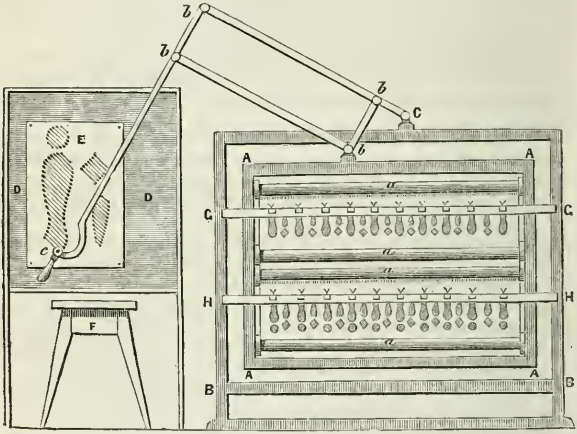
1. The pantagraph and the embroidery frame, attached upon which the fabric to be embroidered is stretched.
2. The arrangement of the needles and the pincers by which they act on the fabric.
3. The locomotive arrangement of the carriages by which the embroidering threads are carried through the fabric.

The diagrams by which the constructive principle of these several parts will be illustrated are not drawn to any scale or relative proportion, but are simply intended to convey, as far as possible, a distinct idea of the leading features of the machine and its operations, and they have been drawn and arranged with that view only.

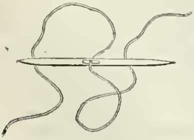
In Fig. 1 we have an elevation of the leading features of the machine, divested of all detail, giving only its essential parts. A, A, A, A, is the embroidery frame, within which the fabric to be embroidered is stretched in two divisions, an upper and lower one, upon rollers *a*, *a*, *a*, *a*. This swings from the outer frame B, B, B, B, at the pivot of the pantagraph C. Every person who understands the action of an ordinary pantagraph, will at once understand that if a figure of suitable design and size is fixed on the vertical plane D, D, as shown in the pattern E, all that will be required in order to copy this pattern to a fixed scale on the plane A, A, A, A, will be to move the pointer c of the lengthened side of the parallelogram *b*, *b*, *b*, *b*, by the handle attached to it. The angles of this parallelogram will become acute or obtuse, just according to the motion required to bring the frame A, A, A, A, into its proper relative position. To effect the copying of the pattern E by a series of stitches, a drawing generally six times the size of the pattern to be embroidered, is made upon a piece of stout paper, or a plate of tin. Each stitch is arranged to this scale, and a hole punched in the paper or plate at each end of every stitch.

Into this hole the pointer of the pantagraph is inserted before each stitch is taken. This point is moved backward and forward across the pattern, upon the system of stitches laid down, by the embroiderer seated on the stool F; and with each motion the needles are drawn backward and forward through the fabric by a corresponding action of the carriages, on the frames of which the pincers which hold the needles are fixed, as indicated; G to G in the upper tier thus embroidering the upper piece of cloth, and H to H in the lower tier, by which the fabric fixed upon the lower pair of rollers is embroidered. The pattern E is thus repeated one-sixth the size, each needle in operation executing a repeat, and the pattern when finished extends the whole width of the fabric at one operation.

Fig. 1.



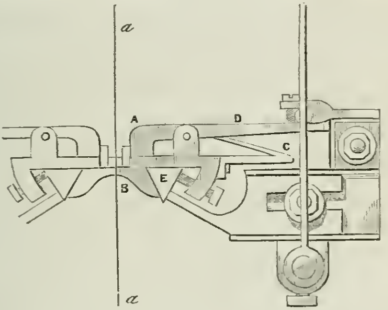
The arrangement of the needles, and the mode by which they are alternately held and released must now be noticed. The needle-holder or pincers act in a manner analogous to the human hands, working from each side of a framework of cloth, placed in a vertical position, the needle being a double-pointed one, with an eye for threading the silk in the middle, thus:—



The pincers are arranged, as already stated, in a double row on two tiers across the frame work of the carriages on each side of the embroidery frame, and project over, so as to come in contact with the fabric when stretched upon it. (See Fig. 3, *a*, *b*, *c*, *d*.) They are placed at one inch and a half from each other, and the larger machines have as many as 75 in each row. The construction of these pincers may be illustrated in profile by Fig. 2.

A is the upper jaw of the pincers, which is kept down upon the needle by the action of the spring, C. By this spring the upper jaw is brought back into its place after the end has been pressed down at D, to release the needle after it has pierced the fabric, (as shown in section at *a a*,) and been received by the opposite pincer. B is the lower jaw, which is, of course, fixed to the frame. The prismatic rule E runs the whole length of each series of pincers, and sustains them, in a perfectly true and corresponding position. The arrangement for the release of the needle after it has been driven through the fabric cannot be easily explained; it must, therefore, suffice to say, that the upper jaw of the pincer is pressed down at the proper time by the action of a rod on the lever end D, and the needle thus released, after having passed through the fabric, is held fast by the opposite pincer, the thread being thus carried to its full tension, as shown in Fig. 3 at F, and then brought back again to the fabric to be taken up in the same manner by the pincer from which it had been released, again to return at each motion of the pantagraph handle indicating another stitch.

Fig. 2.



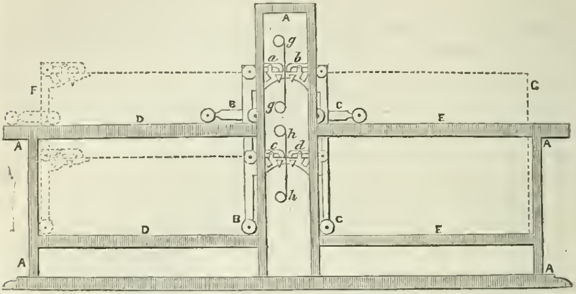
Originally this release of the needles depended upon the worker of the pantagraph, who had to use his or her feet upon treadles provided for the purpose, and attached to the releasing rod. One of the improvements effected by Mr. Henry Houldsworth was a mechanical arrangement by which these treadles were dispensed with and the pantagraph worker or embroiderer proper, released from the duty of attending to two movements. By this arrangement the releasing rod is acted upon by a clock motion, which is brought into play at the instant the carriage is driven against the frame work when the needle passes through the fabric.

The locomotive arrangement of that portion of the machine which carries the pincers and needles, may be understood in its elementary form by a reference to Fig. 3.

A, A, A, A, A, represents the structural frame-work of the machine, and is of iron; B B and C C the carriages acting on each side of the fabric; *a b* and *c d* indicate the position of the pincers carrying the

needles. These carriages run on a species of railway along the horizontal lines D D and E E, and are required to be most accurately fitted. The section of the fabric stretched in a vertical position on the rollers *g g* and *h h*, and passing between the upper and lower tier of pincers, gives the centre line of the diagram.

Fig. 3.



We will now assume that the needles being threaded and fixed in the pincers *b* and *d*, are pushed through the fabric represented as stretched upon the rollers *g g*, *h h*. The needles are released from *b* and *d*, and seized by the pincers *a* and *c*. The carriage B B is then drawn backward to F, until the threads are all drawn equally through the fabric. The needles being threaded in pairs, that is to say, with a thread of double length, these threads are drawn up to their full tension at once. This supersedes the knotting of the thread to prevent its being drawn through the cloth. The embroiderer sitting at the pantagraph moves the point for the first stitch, as shown in Fig. 1 at E, the carriage B B is brought back to the fabric, and the needles forced through into the jaws of the pincers *b d*, again they are released from *a c*, and being duly fastened upon by *b d*, the carriage C C is drawn along the frame until the thread is again at its full tension, when the carriage reaches G. Stitch the first is then complete.

The pantagraph pointer is again moved for another stitch on the enlarged pattern E, Fig. 1, and again the process of bringing up the needles to the fabric—their passing through—their release on one side and their seizure on the other is repeated, and so the work goes on until fresh needles and thread are required, when the same course is repeated in the putting in, and starting the work at the same point at which the last stitch of the former thread left the work incomplete.

Each machine is usually worked by three young women and three or four girls, the latter being employed to thread the needles and prepare them for the machine, that a supply may be always on hand. One young woman—who is generally the most experienced, and acts as the "captain" of the machine—attends to the pantagraph, criticises the work, and directs the motions of the workers of the carriages, who push backward and forward the rows of needles. With an intelli-

gent "captain," quick and skilful workers, and rapid threaders, an elaborate pattern, and a machine in good working order, I know nothing in manufactures more interesting than the embroidering machine. The pattern grows so rapidly under its action; every stitch tells toward the final effect; and the result is at once so satisfactory, that the operation appears to be the realization of the thought of the workers direct from their minds, and with no more mechanism than is necessary to realize that thought.

(To be Continued.)

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*Heat-conducting Power of Metals.**

An elaborate paper, which cannot fail to be of utility to our industrial community, has been communicated to the Royal Society by Professor F. Crace-Calvert and Mr. Richard Johnson on the "Relative Power of Metals and Alloys to Conduct Heat." Before describing the process followed and examining the results obtained, it is necessary to state that they made a great number of experiments, with the hope of solving the important chemical question—are alloys simple mixtures of metals, or are they definite compounds? With this view they operated on a large number of alloys and amalgams, convinced that if the chemical nature of alloys and amalgams is still enveloped in darkness, it is because they have been prepared with impure or commercial metals, and not made in equivalent quantities. The consequence has been that as metals have only a slight affinity to each other, and as the definite compounds which they have a tendency to form were mixed with an excess of one of the metals employed, the alloys produced have presented properties which could lead to no information as to their nature. These difficulties have been increased by the fact that in many alloys, such as those of copper and tin, or copper and zinc, the metals have a tendency, when allowed to cool slowly, to form several crystallizable compounds differing in their composition in the various parts of the alloys, the less fusible being on the exterior and those more so in the interior of the mass. The impurities existing in commercial metals are often so large as considerably to modify the property of their alloys; for they found in their researches that if 1 per cent. of a metal be added to 99 of another, it alters its conducting power most materially. To avoid these causes of error they composed their alloys of pure metals, and employed definite proportions.

The apparatus used appears in every way calculated to give reliable results, and Messrs. Calvert and Johnson's remarks are certainly entitled to be considered the most complete which have yet appeared on the subject. They provided a deal box (105 millims. in width, 165 millims. in length, and 220 millims. in height), with a cover, and painted white internally and externally. Inside this box are two vulcanized india rubber square vessels, the sides of which are 15 millims. thick. The larger vessel measures internally 52 millims. on the side, and 125 millims. deep, and is capable of containing 336 cub. cent. of

* From the Lond. Mining Journal, No. 1230.

water. The smaller vessel is 27 millims. on the side and 125 millims. deep, and has a capacity of 90 cub. cent. These vessels are painted white, and surrounded with wadding; and, still further, to prevent any radiation of heat, a deal board is placed between the two vessels. So little heat is radiated from the larger vessel when it contains 200 cub. cent. of water at 90 deg. to the smaller vessel containing 50 cub. cent. at 16 deg., that in a quarter of an hour, the time required for their experiments, the water in the vessel did not rise one-tenth of a degree centigrade. Therefore all sensible radiation and conduction was avoided, and the rise of temperature in this vessel during the experiment must have been entirely due to the heat conducted by the square bar of metal used. This bar is 6 centims. long and 1 centim. square, and is so arranged in the experiment that 1 cub. cent. is in the larger vessel; 1 cub. cent. in the smaller vessel; 3 cub. cent. are covered by the sides of the boxes through which it passes; and the last 1 cub. cent. is covered with a piece of vulcanized india rubber tubing, and the whole made secure from any leakage by lining the sides of the holes through which the bar passes with a varnish made of caoutchouc dissolved in benzoine. All being ready for the experiment, 50 cub. cent. of water, at the temperature of the room, are poured into the smaller vessel, the boxes covered, and each provided with a very sensitive thermometer, and 200 cub. cent. of boiling water are poured into the larger vessel by means of a funnel; the temperature of the liquid falls to 86 or 88 deg., but is again raised to 90 deg. by a small jet of steam generated in a flask, the water in which is kept boiling during the whole experiment. The conducting power of the metal being tested is noted with the greatest care.

The relative conductibility (taking silver at 1000) of the several metals is—gold pure, 981; gold with 1 per cent. of silver, 840; copper rolled, 845; copper cast, 811; mercury, 677; aluminium, 665; zinc rolled, 641; zinc, cast vertically, 628; zinc, cast horizontally, 608; cadmium, 577; malleable iron, 436; tin, 422; steel, 397; platinum, 380; sodium, 365; cast iron, 359; lead, 287; antimony, cast horizontally, 215; antimony, cast vertically, 192; bismuth, 61. For mercury and sodium they employed a very thin sheet iron box, the internal dimensions of which were exactly those of the square metallic bars they usually employed, and of the conducting power calculated, but the figures are very near the truth. It will be seen on reference to the figures for rolled and cast copper that the molecular condition of metals has an influence on the conductibility, and the influence of crystallization is apparent from the difference of the results obtained from zinc cast vertically and cast horizontally.

Glaze for Earthenware.

M. Hardsmuth proposes the following in place of the ordinary lead glaze:—Take boracic acid, 15 lbs.; calcareous spar, 5 lbs.; clay, 5 lbs.; wood-charcoal, 1 lb. Powder the mixture, and calcine to complete fusion; allow it to cool; powder again and apply it as the common lead glaze is applied.—*Cosmos.*

*New Chemical Balance.** By Mr. J. B. Cooke, of Liverpool.

The balance is an instrument of prime necessity to the exactitude of the results sought for in the operations of the chemist. But it is also a very expensive piece of apparatus, and its delicacy requires it to be guarded with the utmost care from the effects of damp, and the other vapors and fumes incidental to a laboratory. The following is the description of an instrument which has been in constant use for more than a year, and which is at once sensitive, effective, inexpensive, and not liable to injury. It weighs quantities amounting to 2400 grains with an accuracy unmistakeably distinct to the $\frac{1}{10}$th of a grain.

Though freely exposed to an atmosphere which in twelve hours covers a polished iron surface with rust, and which is often loaded with fumes of hydrosulphuric and other acids, it is now as sensitive as on the day of its construction.

The materials of which this balance is composed are to be found in every laboratory. Their first cost need not amount to 5s., and they can be put together by the chemist himself in the course of two or three hours, so as to be in perfect working order.

To those operators whose object is the attainment of accuracy with the smallest expenditure of means, it is hoped that a desideratum is here supplied, although some of the points usually considered essential to a good balance appear to be disregarded.

The beam is formed of glass tube. A piece of barometer tubing of 12 or 18 inches in length, or even the full length of a barometer tube, if economy of space is not important, may be employed. Another glass tube of about 3 inches in length, and of diameter and thickness proportioned to the weight it is destined to bear, is attached to the beam tube at right angles, at about the middle point of each. Exactitude in any of these particulars is not essential. The attachment may be made by any convenient means, say by fine iron wire covered afterwards with sealing-wax melted on to it.

If a portable balance be desired, a suitable stand must, of course, be provided; but if the instrument be intended to occupy a permanent position, it may be made to work upon an open shelf, and the present description applies to the latter circumstances.

Two other glass tubes, of about two inches in length, are cemented longitudinally upon the surface of the shelf, parallel to and at a distance of $1\frac{1}{2}$ inches from each other.

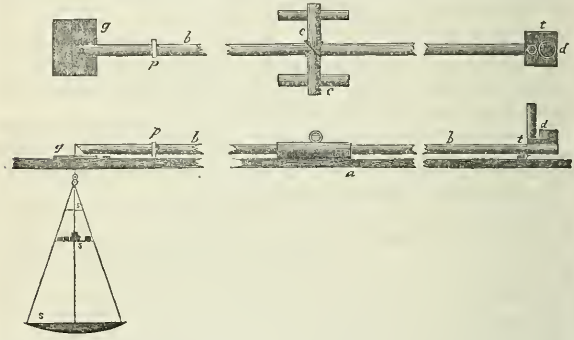
They must be equal to each other in diameter, which must be greater than that of the beam tube, or they must be raised equally to some small distance above the surface of the shelf, so that when the transverse tube attached to the beam is placed across and upon them, the beam itself, lying between and parallel to them, shall be raised at its centre at least $\frac{1}{4}$-inch above the shelf. The three small tubes should be selected of good shape and polish.

By this arrangement the beam, when in equilibrium, is supported

* From the Mechanics' Magazine, April, 1859.

upon two points, which, owing to the roundness, smoothness, hardness, and chemical inertness of the material, approximate closely to mathematical points not liable to injury from oxidation or friction. Knife-edges working upon planes of whatever substance, are not theoretically so perfect in action as the above *points* of support, and it would be difficult with the finest art to make them practically more sensitive.

A piece of sheet-copper is fastened on to the shelf under the beam near each of its ends. An edge of each piece of copper, running transversely to the shelf, is turned up at right angles to serve as a support at such a height that, when one end of the beam, loaded with its full weight, is resting upon one of them, the other end may be separated from its resting place by about $\frac{1}{20}$th of an inch. If the under-surface of the beam be blackened about these places of support, the separation shows very distinctly against a white surface placed behind.



The weights, and substance to be weighed, are both applied at the same end of the beam; the other end being compensated by a constant counterpoise; a peculiar form of scale pan is therefore required. It is convenient to have three tiers of pans hung in a pyramidal form at a suitable distance from each other by the same three silk strings. The largest and lowest is destined for the substance to be weighed. The middle one in size and position for the larger weights, and the smallest and uppermost pan contains the weights below 10 grs. This compound scale pan is suspended by a bent wire to a loop formed at one end of a short silk thread, which, passing vertically through a small hole in the shelf, and bisecting the end-section of the beam tube, is cemented with sealing wax on the upper surface of the tube. The thread should lie in a slight notch filed on the upper circumference of the end of the beam, and should hang freely from it, the lower circumference being ground away to prevent contact. The thread must also of course be carefully protected against contact with the sides of the opening in the shelf. The better way is to make an opening of about one inch square through the wood, and afterwards to cover over the greater por-

tion by four slips of window-glass crossing each other, and leaving only a small hole in the centre for the thread. If this opening be large, the balance will be affected by currents of air which always occur upwards or downwards in such circumstances. The surface of the shelf between the centre of the beam and that end of it to which the pans are hung, is divided into 10 equal parts by ink lines; and a platinum rider weighing $\frac{1}{10}$th grain is applied to this arm of the beam, and by traversing over each division marked on the shelf causes the variation of $\frac{1}{100}$th of a grain, and dispenses with the use of weights smaller than $\frac{1}{10}$th grain.

The sensitiveness of a balance is proportional to the approximation to each other of the centres of suspension and of gravity. In the present instance, the centre of suspension is the central point of the mid-section of the small tube attached to the beam, and since the weights of the beam itself and of the scale pans and their contents, are referred to a point much below this, some provision is required by which the centre of gravity of the whole mass may be considerably raised, and its position nicely regulated. The provision required is found in the mode by which the compensation is applied at the end of the beam destitute of scale pan.

On the upper side of the compensation-end of the beam is cemented horizontally with shell-lac, a table of window-glass of about 1 inch square surface. On this table again are cemented, by the same means, in vertical juxtaposition, two glass tubes; one about 3 inches high and $\frac{1}{4}$-inch in diameter, the other 1 inch high and $\frac{3}{4}$-inch in diameter. A quantity of dry pure mercury is then poured into the tall tube until the beam, whose scale pan is loaded with about $\frac{2}{3}$rds the weight which it is destined to carry, is nearly in a state of equilibrium. If the tall tube be sufficiently high and narrow, it will then be found that the centre of gravity has risen above the centre of suspension, as will be evidenced by the setting of the beam at either end indifferently according as it is placed.

Mercury is now poured gradually into the shorter tube, and after each addition weights are added in the scale pans to produce equilibrium. By every such addition the centre of gravity will be proportionally lowered, and may be brought with the utmost nicety within any assignable distance from the centre of suspension.

The adjustment will suffice for the purpose of the balance, when the transference of the rider over one division of the shelf towards the centre of the beam shall raise this end of the beam from its supports, and the replacing of the rider in its former position, shall restore the preponderance of the weights, and when on frequent trial this is the invariable result.

The balance is thus left with an extremely small amount of overpoise. The substance to be weighed is placed in the lowest pan. Weights are removed from the upper pans, and ultimately the rider is moved over the arm towards the centre, to the point at which the beam is first caused permanently to resume its normal position. The sum of the weights removed, together with the number of degrees passed over

by the rider reckoned as $\frac{1}{100}$ths of a grain, will be the weight required.

The advantages claimed for this balance are, easy construction, cheapness, non-liability to injury from exposure or rough handling, the whole operation of weighing being confined to one end of the beam without loss of sensitiveness, and the separation of the large from the smaller weights.

The engravings illustrate, in plan view and side elevation respectively, the new balance. *a* is the shelf; *b*, the beam; *c c c*, three small tubes; *d d*, tubes for mercury; *s s s*, three scale pans; *g*, glass plates to cover; *h*, hole in shelf; *p*, platinum rider; *t*, small table; and *r r*, copper rests.

The method of mounting is not inferior in sensitiveness to that of the best constructed instruments, and the limits of its sensitiveness are far from being reached in the specimen above described. As an illustration of this assertion, the following rough experiment is adduced. The writer constructed a balance, of which the beam was a tube of thick glass 22 inches long, and 1 inch in external diameter, and weighing alone $1\frac{3}{4}$ lb. The scale pan was loaded with a weight of 1 lb. The compensation was then readily effected with mercury to such accuracy that the translation of a platinum rider weighing $\frac{1}{10}$th gr. along the beam, over a space equal to $\frac{1}{10}$th of the length of the arm, sufficed to change the preponderance in favor of the one arm or the other, according to the direction of its transference. This roughly-formed balance, therefore, which, exclusive of the scale pan, did not occupy two hours in construction and preparation for use, was sensitive to a weight of $\frac{1}{100}$th of a grain, or to $\frac{1}{700000}$th part of the weight to be estimated, and about $\frac{1}{2000000}$th part of the whole weight supported on the fulcrum.

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*Supply of Coal.**

M. de Carnal, one of the greatest owners of coal mines in Prussia, in a statistical work on coal digging, states that the quantity of coal dug in 1857 amounted to 125,000,000 of tons, a mass which piled up 6 ft. high, would cover a geographical square mile. The lands from which the coal is procured, may be estimated at 8000 square miles, and the mean depth of the beds of coal at about 31 feet. The mass of coal, then, known to exist would form a cube of 10 miles. If we compare this enormous bulk of coal with the quantity annually consumed, we may confidently affirm that there is enough to last for 36,000 years. The calculation of 31 ft. for the mean depth of the beds is, perhaps, too low, for the coal fields of Liege extend to 55 ft., those of Staffordshire to 151 ft., and those of Ruhr to 134 ft. The coal dug in 1857 amounted in value to £37,500,000 sterling, a sum far beyond that realized by the digging of the precious metals. In England some calculations have been made with regard to the yield of coal in our own country, according to which the coal fields of Great

* From the London Mining Journal, No. 1236.

Britain yield 63,000,000 tons of coal per year. A better idea of the immense commerce of England could not be formed than by stating the fact that at Manchester and its environs a motive steam power equal to 1,200,000 horses is constantly maintained, to support which there are consumed 30,000 tons of coal per day, or 9,500,000 a year. In the manufacture of salt alone about 3000 tons are consumed per day, or 950,000 a year. The Transatlantic steamers from Liverpool and other ports consume 700,000 tons per year, and the manufacture of gas absorbs 10,000,000 tons per year. The export of coal from England reached, in 1858, 6,078,000 tons. It is estimated that England alone could furnish enough coal for the consumption of the whole of Europe for 4000 years.

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*How Great Guns are Made.**

In our last week's number something was said about the quality and character of iron requisite for producing sound heavy guns, and the experiments made at Woolwich during the last two years were referred to. This week we propose to give further information on the important subject, and more especially in reference to the furnaces and other appliances connected with the Woolwich factories. A 68 ℔. gun, when finished, is 17 feet long, 28 inches in diameter at the breech, and weighs 95 cwt. As guns of this description are cast vertically, and require a "dead head" of considerable magnitude in order to insure sufficient density, it may be imagined that the furnaces are matters of important consideration. In practice it was found advisable to use two furnaces in the melting of a sufficient quantity of iron for the production of one such gun as we have described. The Woolwich furnaces would each hold sufficient molten metal for the casting of one gun, but as it was not possible to charge with ten tons of pig iron at once, it was found better in every way to charge two furnaces with five tons, and melt simultaneously. The quality of the iron produced in this way was found to be superior to that resulting from one furnace, when a portion of the charge must have been melted first and the remainder afterwards. Repeated tests proved this fact to demonstration, and it is a practical point of much consequence. The Woolwich furnaces are partly constructed of Stourbridge fire-brick, but the beds are of a different material. The throwing in of old "carronades," "dead heads," and "pigs," was found to chip off, or to crack and destroy the fire-bricks, and a substitute for these, in the construction of the furnace beds, had to be found. A cheaper substance, and one which admits of easy repair, is now used. It is composed of equal parts of glass-grinders' sand and blackfoot sand. The former is the refuse from the Thames patent glass works, and contains a considerable admixture of fine particles of glass, and the latter is obtained from the sand pits at Charlton. These are amalgamated, rammed hard upon the foundation of the furnace, and, after the application of heat, form a vitrified surface,

* From the Lond. Mechanics' Magazine, April, 1859.

impervious to liquid iron. The sand furnace bed is, in point of efficiency and economy, immeasurably superior to that of fire-brick, and we strongly recommend it. With respect to the dimensions of the furnaces, it may be stated that they are about 22 ft. long, from centre of fire-grate to centre of chimney; 5 ft. 2 in. wide; and 2 ft. 6 in. in height from bed to crown. The fire-grate is 5 ft. 2 in. square, and open for the admission of air at the end of the furnace, and the chimney is 60 ft. in height and 2 ft. 6 in. square. The furnaces are always heated before receiving their charges, and when the latter are sufficiently fluid and hot, the molten streams from two furnaces, as we have stated, are made to flow through separate channels into one reservoir. Here they mingle and blend for a little time in one harmonious whole, so as to equalize any difference of temperature which may have existed prior to their being tapped. Metal is now ladled in small quantities from the reservoir for the purpose of casting testing bars, and a sluice door being opened the molten ocean courses its way down river-like into the centre of the gun mould, which is placed vertically, and muzzle upwards to receive it. Scoria and other impurities float upwards as the metal rises, and great precautions are taken to prevent their flowing with the iron into the "trunnions," which they would weaken, and thus render the whole casting useless. When the metal reaches to within a few inches of the guide shute, the flood-gates through which it flowed are shut for a minute until the shute is removed, and then again opened for the complete filling of the mould. In cooling there is a great subsidence of the metal, especially in the centre, but the hollowness thus produced is in the dead head entirely, and by no means deteriorates the gun. Everything is suffered to remain *in statu quo* for about three days and nights after the pouring operation. The mould is then opened, and the casting, usually perfect, is prepared by lathe and boring mill for proving, and mayhap for battle. Such is some account of the gestation and birth of a great gun, and which, in these non-piping times of war, may be acceptable to the public generally, and certainly must be to the scientific reader.

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*Bonelli's Electric Loom.**

At the meeting of the 7th ult. of the Académie des Sciences, M. de Senazcourt informed the members that M. Froment has completed important improvements in the electric loom invented by Chevalier Bonelli, director of the Sardinian telegraph, which figured at the Paris Exhibition of 1855, and a commission was named to examine it and make a report to the Academy. M. Chevreuil stated that he had been to see it at work, accompanied by the President of the Chamber of Commerce and other gentlemen, and had been astonished at the results obtained. The invention consists chiefly in replacing the Jacquard cards by a thin sheet of tin on which the design to be reproduced on the fabric is figured with varnish or isolating ink. The beat up of the

*From the Lond. Mechanics' Magazine, April, 1859.

batten brings a metallic comb, formed of small separate teeth, into contact with the design, when some of the teeth touch the varnish of the design, and others touch the metal; and those teeth in contact with the metal alone give passage to the electric fluid supplied by a Bunsen pile, and convey it to the small electro-magnets with which they are connected by means of a thin copper wire. These electro-magnets act upon an equal number of small iron rods to keep them out of the way of the wires of the Jacquard, while those teeth which come in contact with the varnish of the pattern are allowed to project against the wires of the Jacquard, to act upon them in the same manner as the cards now used. As a proof of the ease with which new patterns can be applied, when the Emperor and Empress were lately visiting the *Ateliers* to inspect the loom, M. Froment, without interrupting the work, replaced the design in course of execution by a band of tin, on which he had written the words Napoleon III., which were seen to follow on the fabric, the flowers composing the first design.

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*The Oyster Manufacture.**

Although oysters are not exactly spun and woven like cotton, or smelted and rolled like iron, their artificial production has advanced so far as to put the process pretty much in the light of a manufacture. The sowing and breeding of oysters has long been an important branch of our industry; and now the French government has set steadily to work with the matter, on a grand scale, on the coast of France. The place chosen for the experiments in question, is a part of the Bay of St. Brieuc, a spot naturally well situated, and which, for an extent of 12,000 hectares ($2\frac{1}{2}$ acres each,) is very favorable for the breeding of oysters, the bottom being shelly sand, slightly mixed with clay or mud. The tide, which there runs from N. W. to S. W., and from S. W. to N. W., at the rate of about three miles an hour, keeps the water constantly renewed, and carries off all unhealthy deposits, and contracts, by breaking against the rocks on the shore, the necessary vivifying properties. The immersion of the breeding oysters was commenced in March and concluded about the end of April, during which time about 3,000,000 of oysters, taken some from the sea and others from the banks at Cancale and Treguler, were distributed in ten longitudinal beds in different parts of the bay, forming together a superficies of 1000 hectares. The position for these banks had been traced out beforehand on a chart, and floating flags were placed to direct the movement of the vessels engaged in the operation. In order that the immersion of the oysters should be made with perfect regularity, and that the female oysters should not be injured by lying too thickly one over the other, two steamers, towing boats laden with oysters, proceeded from one end of the bank marked out to the other, letting down the oysters as they went, and then, when reaching the other end, turning round and retracing their way, thus distributing the fish with as much regularity

* From the Lond. Practical Mechanic's Journal, May, 1859.

as a plough could turn up a furrow in a field. After having laid down the oysters in conditions most favorable for their multiplication, it was necessary to organize around and over them prompt means for collecting the spawn, and constraining it to fix itself on the spot. One of the plans adopted to accomplish this object was to cover the bottom of the new bed with old oyster shells, so that not a single embryo could fall without finding a solid body to fix itself to. The second plan, as already stated in a former report, was to place long lines of boughs of trees, arranged like fascines, from one extremity of each bed to the other. These fascines were ballasted by a weight placed at the bottom, and the tops of them when fixed in their position, stood about eighteen or twenty inches above the bed of oysters, and thus prevented any of the spawn from being carried away by the current. These fascines were placed by men with diving dresses. As the cords with which the fascines were at first fastened would soon wear out, the report states that they may hereafter be replaced by small chains of galvanized iron, manufactured for the purpose in the arsenals of the State. The most exact indications have been made on the chart of the bay, so that the fascines may be taken up as regularly, in order that the oysters attached to them may be collected, as a farmer could pick the fruit from his trees. The report then goes on to say that, although six months have scarcely elapsed since the operations were performed, the result has exceeded the most sanguine expectations. The banks of Cancale and of Granville, in their most prosperous days, never showed such an amount of production. The fascines have on their branches such clumps of oysters that they resemble trees in an orchard, the boughs of which are in the spring hidden by the exuberance of the blossoms. They may be called real petrefactions. One of those fascines, which had been brought to Paris in order that his Majesty might judge of the effect of the plan, had young oysters on it to the number of 20,000. They are already more than an inch in diameter, and they only occupied in the water the space which would be covered by a sheaf of corn in a field. These oysters, when they have arrived at perfection, will be worth at the current price, at least £16. The bay of St. Brieuc will consequently become a really rich treasury, if other beds similar to those already formed be laid down there.

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*How the Earth is Peopled.**

The Director of the Statistical Bureau of Berlin furnishes the following curious statement:—"The population of the whole earth is estimated to be 1,288,000,000, viz:—Europe, 272,000,000; Asia, 755,000,000; Africa, 200,000,000; America, 59,000,000; and Australia, 2,000,000. The population of Europe is thus subdivided:—Russia contains 62,000,000; the Austrian States, 36,398,620; France, 36,-039,364; Great Britain and Ireland, 27,488,853; Prussia, 17,089,407; Turkey, 18,740,000; Spain 15,518,000; the Two Sicilies, 8,616,922;

* From the Lond. Practical Mechanic's Journal, May, 1859.

Sweden and Norway, 5,072,820; Sardinia, 4,976,034; Belgium, 4,607,-066; Bavaria, 4,547,239; the Netherlands, 3,487,617; Portugal, 3,471,199; the Papal States, 3,100,000; Switzerland, 2,494,500; Denmark, 2,468,648. In Asia, the Chinese Empire contains 400,000,-000; the East Indies, 171,000,000; the Indian Archipelago, 80,000,000; Japan, 35,000,000; Hindostan and Asiatic Turkey, each 15,000,000. In America, the United States are computed to contain 23,191,876; Brazil, 7,677,800; Mexico, 7,661,520. In the several nations of the earth there are 335,000,000 of Christians (of whom 170,000,000 are Papists, 89,000,000 Protestants, and 76,000,000 followers of the Greek Church). The number of Jews amounts to 5,000,000; of these 2,890,750 are in Europe, viz:—1,250,000 in European Russia, 853,304 in Austria, 234,248 in Prussia, 192,176 in other parts of Germany, 62,470 in the Netherlands, 33,953 in Italy, 73,995 in France, 36,000 in Great Britain, and 70,000 in Turkey. The followers of various Asiatic religions are estimated at 600,000,000, Mahomedans at 160,000,000, and "Heathens" (the Gentiles proper), at 200,000,000.

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*On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure rapid and certain communication.** By S. Alfred Varley, Assoc. Inst. C. E.

(Continued from page 138.)

There are only two ways of reducing induction, the one is to increase the thickness of the insulating material, and so render the conditions less favorable for its development, and thus approach the conditions of a suspended circuit, where the induction having to take place through a considerable space of air—a dielectric of very low specific inductive capacity—there is but little accumulation of statical charge, and consequently the impetus is almost entirely directed forward, and scarcely diverted laterally to any appreciable extent.

In gutta percha covered wires, when the insulating material is increased in size, it has been shown that the full effect of the increased thickness is not obtained, owing to the outer surface increasing at the same time.

There is also another quality possessed by resinous substances, and probably by gutta percha, worthy of consideration. It is the property of absorbing a charge in the mass of the substance, instead of its being confined entirely to the surface; the tendency of this will be to still further reduce the advantage of an increased thickness of insulating material.

A reference to first principles will make this clearer.

All bodies insulate to a certain extent, and the only difference between a so-called conductor and insulator that would appear to exist, is a difference of degree, and if a charged body is brought into the neighborhood of an insulated conductor, induction will take place

* From the Jour. of the Society of Arts, No. 332.

through it in the same way as through a dielectric, but owing to the particles of conducting substances possessing the property of readily communicating their forces one to another, the inductive force developed at the further extremity will, within certain limits, be scarcely affected by the length of the conductor through which induction is taking place.

The absorption of a charge within the substance of the dielectric is an approach to this condition, but its practical moment when gutta percha is the insulating substance has to be determined by experiment.

Lessening the induction by reducing the resistance has next to be considered.

The first thing obviously will be to obtain a metal of the highest specific conducting power, for could the sectional area be diminished without increasing the resistance, the induction would be reduced proportionately to the decrease in the surface. The next will be to increase the sectional area of the conductor, and although this involves increased surface, yet there will be a gain; for when the diameter of a wire is enlarged, the surface over which the amount of induction extends does not increase in the same ratio as the sectional area which determines the resistance opposed by a conductor. To make this clearer, let four cables arranged side by side be employed as one conductor.

Such an arrangement will possess four times the sectional area, and oppose only one-fourth the resistance; in other words, the same tension of current will force through four times the dynamic quantity of electricity that would be generated through the single cable when used alone. Signals would not, however, be transmitted more rapidly through the four cables than through the one, for although the conducting power has been increased four times, the surface has been quadrupled also, which will exactly counterbalance the lessened resistance; but merge the four into one, the external inductive surface will then be halved, whilst the sectional area will remain the same as before, and there will be only half the induction manifested.

It therefore follows when a wire is enlarged, that as the sectional area increases as the square, whilst the surface increases only in regular proportionals, the relative balance of forces in favor of rapidity of conduction will, in a submarine conductor of a given size, be twice the amount of that in a wire of half the diameter.

I would now attempt an explanation of how it happened that an actual retardation was observed in some of the experiments with the Atlantic cable when a conductor of enlarged sectional area was employed; and on this head I would again quote from my remarks on a former occasion:—

"In the experiments to ascertain whether any advantage would result from the use of an increased sectional area of metallic conductor, recourse was had to joining the cables side by side, the increased inductive surface with such an arrangement involved having possibly been overlooked. This will account not only for an increased speed not having been obtained, but for an actual retardation having been

noticed. Electro-magnetic induction coils do not create electricity, they simply offer a ready means of converting electricity of a low tension and considerable dynamic quantity into electricity of very high tension and small dynamic quantity. The quantity evolved by them is always smaller in proportion as the intensity is greater. Both cannot readily be obtained together, and if a very high intensity is required, the quantity must be sacrificed, unless the size of the apparatus is immensely increased. This difficulty has evidently been appreciated, as the induction coils used by the Atlantic Telegraph Company are of large size and great length, so as to obtain high tension with an appreciable dynamic quantity. Nevertheless, there is little doubt but that the quantity evolved even by these machines, when compared with that generated from voltaic batteries, is small. This being the case, on giving the current a larger number of channels to rush into, there is not enough electricity to fill the wires, consequently the tension of the current will be very much lowered. The effect of this will be that a longer time will elapse before the tension of the wire will be raised sufficiently high at the further extremity to render itself apparent on the instrument. To obtain, under such conditions, the same speed with four cables as would be obtained with one alone, it would be necessary to employ four of these induction coils, ranged side by side, and worked with four times the battery surface, so as to generate four times the dynamic quantity of electricity. When qualified with these conditions, under which, no doubt, the experiments were tried, the reasoning contained in the Atlantic Telegraph Company's pamphlet, given in an earlier portion of this paper, is correct. It is precisely a case of having four Leyden arrangements to charge instead of one. A telegraph cable is, in fact, a Leyden arrangement, which has to be charged to a certain degree of saturation, before signals are obtained. The degree to which it has to be charged, statically, depends upon the extent of inductive surface compared to the conductibility of the metallic core. In a circuit where the conductibility of the metallic core is very great, compared with the inductive surface of the insulating material, no high degree of statical charge can take place, and signals will pass quickly. The opposite effect will be noticed in a circuit where the inductive surface is very large compared with the conductibility of the metallic core. The wire will then have to be statically charged very highly, before a perceptible current will flow from the further extremity, and signals will be obtained proportionately more slowly."*

The reason why signals are found to pass when magneto-electric induced currents are employed in place of voltaic ones arises, I believe, not from any specific difference between them, but simply from the tension of the induced currents being very much greater than any voltaic ones which have been employed.

On this head I will say nothing further here, but would refer those who may take an interest in it to my paper of a former occasion, where I have fully entered into this subject, and also attempted an explanation of how it has happened that in the experiments with voltaic

* *Vide*, "The Atlantic Telegraph."

currents, of varying intensities, no difference of speed has as yet been observed.

The amount of retardation which will be experienced in submarine circuits possessing conductors of varying resistance, and insulated with different thicknesses of insulating material, it appears to me can, comparatively speaking, be readily determined by actual experiment.

I have for a long time been engaged in designing an apparatus for this purpose, and at the time I arranged to give this paper, I fully expected to have had the apparatus completed by this time, and to have been able to have laid it before you on this occasion; and, though I regret not being able to do this, yet I feel I have sufficiently advanced to warrant my explaining the principles of its construction.

The principles upon which it is based are: that a body which offers the same resistance as another, without reference to its substance or length, may, as far as conducting power is concerned, be considered electrically the same. If we make use of a substance or metal of any inferior specific conducting capacity to that of the metal employed in submarine circuits, and also of greatly diminished sectional area, the same resistance as that offered by the very longest circuits can be obtained in a very small compass; and such an arrangement will, as far as simple conducting power is concerned, fairly represent a long submarine circuit.

The induction which manifests itself in submarine circuits can also be obtained if the conditions for its development are as favorable as they are in submarine conductors.

The apparatus consists 1st, of a series of resistances, the values of which are known.

2d, Of a series of induction plates, the values of which, when compared with a given surface of gutta percha coated wire, are also known.

3d, A mechanical arrangement to accurately measure minute periods of time.

By a combination of these resistances and the induction plates, a conductor, which will fairly represent a submarine circuit, will be obtained.

The resistance can be diminished or increased, and the inductive surface can be doubled or halved at pleasure, and thus circuits with conductors of varying lengths and sectional area, and different thicknesses of insulating material, be imitated, and the law which governs the retardation in the transmission of telegraphic signals determined by direct experiment.

It may be argued that as the inductive surface in a telegraphic circuit is uniformly spread throughout, a series of induction plates will not present the same conditions, but it is evident that they may be divided throughout also, and although they will not then precisely represent what is actually the case, the result will approximate very closely to those obtained from a submarine conductor.

Perhaps it would have been prudent not to have called attention to an apparatus before its completion. I have done so, however, because I have felt it was due from me to endeavor, at least, to point out how

some of the important problems involved in submarine telegraphic communications between distant stations may be resolved.

The chief deductions from what has been brought forward in this paper are :—

1st, That the metallic core of a submarine cable should be composed of a conductor of the highest specific conducting capacity.

2d, That a decrease in the retardation which is caused by the induction that takes place in submarine circuits, can only be obtained by increasing the thickness of the insulating material, or by using a wire of larger dimensions; but that it will be better to do this by enlarging the sectional area of the conductor as much as is practicable.

In designing a cable there are many considerations besides those of its simple electrical qualifications which have to be entertained. The object to be obtained is the best result with the most economical investment of money. Are the proportions which were adopted in the Atlantic cable the best to ensure this?

The weight of the conducting coil in this cable is about 93 lbs. to the mile, the value of which, speaking roughly, would, I suppose, be about as many shillings. When served with gutta percha its value was raised to £40 per mile. The iron sheathing and getting the cable on board brought its value up to £100 per mile. The expenditure, however, did not cease here; there were the hire of ships, salaries of staff, &c., &c. In this cable, therefore, only four per cent. at the outside was invested in the conductor upon which the transmission of the messages depended.

If the views which I have brought forward are correct, a conductor of double the diameter would only possess half the amount of retarding force of one of half the size. Such a conductor, at the very outside, would not cost more than £19 per mile, and the increased expenditure, in serving such a conductor with gutta percha, and giving it an iron sheathing, would not, comparatively speaking, be very large; the expenses of the staff and the hire of ships would be about the same in both cases: the latter would be, perhaps, increased slightly, but not to any material amount.

There are a great many other points which should be entertained in such a paper as this, but the paper has already run out to such a length that I will not trespass any further on your patience; and in conclusion I would only add, that if the ventilation of the subject, through the medium of this communication, should tend in any way to the progress of Electric Telegraphy, the object of its author will have been obtained.*

Discussion.—The CHAIRMAN, in inviting the electricians present to take part in the discussion, would call their attention to the generally scientific character of the paper, although there was a passage towards the close of it which opened up a practical question of great import-

* See excerpt minutes of Proceedings of the Institution of Civil Engineers, Vol. xvi., Session 1856–'57.
See "The Atlantic Telegraph. A History of Preliminary Experimental Proceedings, &c., published by order of the Directors of the Company," pages 20, 23. 25, 26, and 40.
See also the *Engineer* of December and January, 1858–'59. "A discussion on the Induction in Submarine Circuits, by X. Y. Z., G. Blair, M. A., Telegraphic Engineer, and J. Tatlock.

ance. Even if this had not been so, he thought in a society like this, where they dealt generally with the practical application of scientific principles, he would have been justified in inviting gentlemen to enter more particularly into the practical application of the theory which had been so ably brought before them. He would call their attention especially to one view which had been expressed very clearly with regard to the difference which existed between the Leyden jar and a long line of insulated wire with a distant termination connected with the earth. Mr. Varley had put before them what insulation practically was in such a case. It was not the separation of a body in an electrical state entirely from all surrounding substances, but the amount of resistance offered by the long wire before it terminated in the earth. This distinction had been brought before them in a very lucid manner, and he thought they were much indebted to Mr. Varley for having done so. He hoped gentlemen present would give their ideas as to the proportion of metallic conductor that should be used in long lengths of submarine cables, such as that between this country and America; also, as to the mode in which the conducting medium should be constructed—whether of a single or a compound wire. This, however, was not the whole question; they had to consider not only the thickness of the wire and insulator, but also whether the insulating substance—gutta percha—was the best that could be adopted for the purpose, and whether before the next great experiment was tried with an Atlantic cable, they could not obtain further light with respect to the insulating medium that was best adapted to a length of cable of that description, both as to cheapness and the power of resisting the pressure of the water, although he thought cheapness in that part of the conductor was a matter of minor importance. It appeared that the conductor itself was only 4 per cent. of the whole cost of the last great experiment to America. The additional cost of the conducting medium, even to the extent of 8 or 10 per cent., was not to be considered for a moment, but the point was, whether by increasing the dimensions of the conducting medium, they did not at the same time increase the amount of induction. He should be glad to hear the views of Mr. Walker on this subject, as that gentleman's experience would be most valuable.

Mr. C. V. Walker had attended to listen and learn, rather than obtrude his own views upon the meeting, but, being called upon, he would offer a few observations. The difference which Mr. Varley remarked between the Leyden jar and a submarine cable, was that which was generally recognised; it was simply a difference of degree as to the relative states of the inner and outer coating. The cable did practically possess all the distinctive character of the Leyden jar, notwithstanding that the inner and outer coatings were connected, as the experiments made with the Atlantic cable illustrated. The experiments worked out in the early part of the paper to determine the law of induction, would be found very clearly laid down by Sir William Snow Harris in the little book published by Weale. He had shewn that the law of induction was inversely as the distance, and directly as the

surface. The next clause of the paper referred to "intensity." This term had led to much confusion; moreover he thought in the present state of electrical science the conditions regarding conduction were far more completely expressed by the formula of Professor Ohm, than by Mr. Varley's diagrams. Another question in connexion with submarine cables was the size of the conducting wires. This was a very important one, and he was quite sure they would think he was possessed of very little modesty if he ventured to give judgment upon a matter which, in his opinion, was so entirely a question of experiment that he only wondered the great cable was laid down before this important point had been satisfactorily investigated, so as to put the matter beyond the possibility of question, whether that conducting strand of seven wires was too large or too small. An opportunity occurred to him to try some experiments with seven or eight distinct miles of insulated wires of different sizes and different thicknesses of gutta percha insulation. The wires were in lengths of about one mile each, and the results of those experiments were decidedly in favor of a small wire as the conducting medium. There were many points in connexion with small wires worthy of consideration, one of which was cheapness, because, although the per centage of saving upon a mile of wire was small, yet the saving would be very great in a cable to extend across the Atlantic. The smaller the wire was the greater the insulating power obtained from the same amount of gutta percha. The alleged advantage of the smaller wire was, that there was a greater resistance in the circuit: but, in the pamphlet published by the Atlantic Telegraph Company, the experiments made by Mr. Reid were described, from which it appeared that he sent a signal through 1000 miles of cable with a battery of two plates only, excited by his tongue, so that the resistance to be overcome by that small battery could not have been great. Another point was the return wire, and upon that he considered the whole question of the Atlantic cable turned. What helped them on the one hand hindered them on the other. The effects of the magnetic disturbances of the earth would be obviated by a return wire. If two lines of cable were laid down, and the current passed to Newfoundland by one wire and returned by the other, this inconvenience would be got rid of, but they would have the other inconveniences which Mr. Varley had laid before them. If the two wires formed portions of the same cable they would cause a greater amount of retardation, because one wire would polarize the other. But if two wires were used in the same cable in a somewhat different fashion, namely, if one was laid as the centre wire, and the other carried spirally round it, and the current divided between the two wires, the polarization would be very much reduced, if not entirely annihilated. Those two wires, however, would act externally upon the outer coating, which would render the advantage nugatory. In his opinion the next Atlantic cable would not be coated with an iron jacket, as the former one had been; but a coating of hemp and other non-conducting materials would be employed. It might be interesting to the meeting to know the time

it actually took to send signals through the Atlantic cable. By Whitehouse's induction coil it took $1\frac{3}{4}$ seconds, whilst the battery current was 6 seconds in its passage through, at least as far as he recollected.

Professor TYNDALL said that the paper displayed a considerable amount of research, and an extensive acquaintance with the ordinarily accepted laws of electricity, as well as with the phenomena of retardation and induction. He would express the feeling that beset him, as he heard the paper read; and he spoke with all frankness and all respect to Mr. Varley and those who, like him, were engaged in these researches, when he said that knowledge such as had been displayed in this paper, ought to be somewhat like the manure that was applied to agricultural purposes: it ought to be put under ground, and new fruits ought to sprout from it. He had been looking intently for the results of this knowledge which had been brought before them; some of it was interesting, but for the most part, it did not deal with facts, but rather with conjecture, more or less ingenious. The whole subject involved a complicated problem. There was not a shadow of doubt that each element of it could, by proper experiment, be separated from the rest, and its due influence described with certainty; and this was what ought to be done, instead of speculating upon the laws of electricity. He thought those speculations ought to be the private property of the man who worked the subject; they ought to guide him in his searches after facts; and if he produced the facts, he could then show the connection there was between the facts and the first principles of the science. He would refer more particularly to what he should himself like to see done. He had heard remarks about thickening the wire and the surrounding insulation. He would ask had any particular experiments been made to ascertain the law of, or the benefit to be derived from, thickening the wire? Had experiments been made to determine the law by which retardation was diminished, when the thickness of the gutta percha coating was increased? They could take the absolute wires that were to be used, and cover them with gutta percha and india rubber, and compare them, and they could tell with certainty which was the best insulator. They could tell the influence of the thickness of the wire, and the thickness of the insulator; and he thought their knowledge of the principles of electricity ought to be the guiding light to carry their minds to the determination of these cardinal points.

(To be Continued.)

Artificial Wood.

In one of his last lectures at the "*Conservatoire des Arts et Metiers,*" M. Payen called the attention of his hearers to the process of making a kind of ebony or artificial wood, very hard, very heavy, and capable of receiving a very high polish and a brilliant varnish. M. Ladry, the inventor of this process, takes very fine saw-dust, mixes it with blood from the slaughter-houses, and submits the resulting paste to a very

heavy pressure obtained by the hydraulic press. If the paste has been enclosed in moulds it will take the form of the mould, and resembles pieces of ebony carved by a skilful hand.

Another curious application of this paste consists in the formation of brushes; the bristles are arranged in the paste while yet soft; the paste is covered by a plate pierced with holes, through which the bristles pass; the pressure is then applied, and brushes are obtained, made of a single piece, cheaper and more lasting than the usual kind. This artificial wood of M. Ladry is much heavier than common woods.—*Cosmos.*

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*Alloy of Steel.**

Experiments have been made at Vienna, Dresden, and other places, in the use of tungsten or wolfram in the alloying of steel, and some extraordinary results are stated to have been achieved. It is said that steel alloyed with 20 per cent. of tungsten produces a mixture, which, while it retains all the general qualities of steel, is so excessively hard that tools made of it will cut, without difficulty, the hardest cast steel. Large quantities of the new alloyed metal are said to be in preparation, and a company is about to be formed to work the discovery.

Uniform Musical Diapason.†

Very considerable inconvenience has long been felt in the musical world in consequence of the want of a uniform standard by which the pitch of musical instruments, whether used individually or in concert, might be regulated. The tendency in all the most celebrated orchestras to an increased elevation of pitch has been attended by evils which affect the interests of music in no small degree. Composers, instrument-makers, and artists are alike sufferers from this cause, and the great difference existing between the pitches (or diapasons, as they are called,) of various countries, or of various musical establishments, is frequently a fertile source of embarrassment in musical transactions. With a view to remedy this acknowledged and growing evil, the French government some time ago appointed a commission of distinguished men to discuss and collect information upon the whole question; and the result of their labors has lately appeared in the *Moniteur*, in the shape of a very elaborate and interesting report.‡

The commission consisted of fourteen members, all of them eminent in the world of music or science, as the following enumeration of their names will show:—Pelletier (Secretary-General in the Ministry of State, President), Halévy, Auber, Berlioz, Despretz (Professor of Physics at the Faculty of Science), Camille Doucet (Ministerial Head of the Theatrical Department), Lissajous (Professor of Physics at the

* From the Lond. Mechanics' Mag., April, 1859. † From the Lond. Jour. of the Soc. of Arts, No. 339.

‡ Rapport présenté à son Excellence le Ministre d'Etat par la Commission chargée d'établir en France un Diapason Musical Uniforme.

Lycée St. Louis, and Member of the Council of the Society for the Encouragement of Works of National Industry), General Mellinet (Superintendent of the Bands of the Army), Meyerbeer, Monnais (Imperial Commissary at the Lyrical Theatre, and at the Conservatoire), Rossini, and Ambroise Thomas. Any opinions emanating from a body of men so well qualified to judge upon a subject of this nature, must necessarily be worthy of attention; and we think, therefore, that a short summary of their report may not be uninteresting to the musical portion of our readers.

The report commences by stating that it is an undoubted fact that the diapason or pitch, has been steadily rising for at least a hundred years, and that it is now quite a whole tone higher than it was in the middle of the last century. As a proof of this, we have the internal evidence of the scores of Gluck, Monsigny, Grétry, and others, besides the more certain testimony of the organs of the time. Rousseau (*Dictionnaire de la Musique*, article *Ton*,) states that the pitch of the opera in his time was lower than that of the chapel, and consequently more than a tone lower than that of the opera of the present day. The first question, then, that naturally presents itself for consideration is, what were the causes which have led to this result? Vocalists cannot fairly be charged with any participation in producing this change. They screamed, it seems, even in those days, without the facilities afforded them by the operas of Signor Verdi. Besides, it is manifestly never for the interest of the singer that the diapason should be forced up—a circumstance which can only tend to increase his fatigue and make inroads upon his voice. The interests, too, of composers are, for many reasons, opposed to an undue elevation of the pitch. They have, moreover, but little power of influencing an orchestra in this respect. The composer does not fix the diapason—he submits to it. It is, then, says the report, to the instrumentalists and the instrument-makers that this result must be attributed. They are the persons who have evidently a joint interest in raising the diapason of the orchestra. Up to a certain point, the more elevated the pitch the greater the brilliancy and sonority of an instrument.

The numerous inventions and improvements which have been effected in wind instruments have more than anything induced the unnatural height which the diapason has now reached. A direct confirmation of this is afforded in a particular instance by a letter addressed to the commission by M. Kittl, the director of the conservatory at Prague, who states that the Emperor Alexander I., upon becoming proprietor of an Austrian regiment, ordered new instruments to be made for the band. The manufacturer, in order to increase the brilliancy of tone, raised the pitch considerably. This having produced the desired effect, the example was followed by other military bands, who all raised their diapason.

With the view of obtaining as much valuable information as possible upon the subject, which is one of universal interest to musical art, the commission wrote to all the most celebrated musical centres in England, Belgium, Holland, Italy, and America. Almost all the answers

which they received agree in their estimation of the importance of the subject, and in deprecating the undue height of the diapasons now in use. Some of these communications, coming as they do from composers and conductors of the first eminence, are very interesting. It would, however, occupy more space than we can afford, to attempt any thing more than a very brief mention of one or two of the most striking. Reissiger writes from Dresden that he hopes all Europe will warmly applaud the establishment of the commission. The great elevation of the pitch, in his opinion, destroys the effect and effaces the character of ancient music—of the master-pieces of Mozart, Gluck, and Beethoven. Ferdinand David, Franz Abt, and Lachner, express with equal decision their approval of the step which the French government has taken. Herr Wieprecht, the director of the military music of Prussia, and Dr. Furke, each forwarded able papers upon the subject, and manifested a lively sympathy with the objects which the commission had in view. From several quarters tuning forks, to the number of twenty-five, were received. Of these Messrs. Broadwood sent three, which afford a striking example of the necessity which exists in our own country for some re-adjustment and assimilation of the pitches now in use. The first is a quarter of a tone lower than that of Paris, and is used exclusively for piano-fortes destined to be employed for the accompaniments at vocal concerts. This, it seems, was the pitch used about thirty years ago by the Philharmonic Society. The second, which is higher than the Paris pitch, is that to which Messrs. Broadwood ordinarily tune their instruments, as being most likely in general to be in tune with harmoniums, flutes, &c. It is the diapason of instrumentalists. The third, still higher, is that now used by the Philharmonic Society, and, with one exception—viz: that employed in the band of the Belgium regiment of guides—is the highest which the commission received. This latter vibrates nine hundred and eleven times in a second, whereas the No. 1 of the Messrs. Broadwood, the lowest of all the tuning forks sent in, gives only eight hundred and sixty-eight vibrations in the same time. This difference is nearly equivalent to a semitone.

With these and various other similar communications before them, the commissioners unanimously came to the conclusion that it was desirable—first, that the diapason should be lowered; and, secondly, that when so lowered, it should be taken as an invariable regulator. The determination of the particular diapason to be adopted naturally presented considerable difficulties, and accordingly led to some diversity of opinion. All agreed that a depression of more than a semitone was neither practicable nor necessary. One member alone advocated a depression of less than a quarter of a tone. He, indeed, proposed that the alteration should at the most extend to half a quarter of a tone—fearing that any greater change, coming suddenly into operation, might act prejudicially upon the trade in musical instruments, which is one of the most successful branches of French industry. It is difficult, however, to see much force in this objection, when we consider the great variety which exists in the diapasons already in use

throughout Europe. In a letter addressed to the Minister of State by the principal French instrument-makers, they enlarge upon the embarrassment resulting "from the continually increasing elevation of the diapason, and from the variety of diapasons," and go on to request his Excellency "to put an end to this kind of anarchy, and to render to the musical world a service as important as that rendered to the industrial world by the creation of a uniform system of measures." It is evident from this that the manufacturers themselves do not regard with apprehension the contemplated change of diapason.

Ultimately, a depression of a quarter of a tone was fixed upon. This, it was thought, would afford an appreciable relief to vocalists; and, "without introducing too great a derangement in established habits, insinuate itself, so to speak, *incognito* into the presence of the public. It would render the execution of the ancient master-pieces more easy; it would lead us back to the diapason employed (in Paris) about thirty years ago—the period of the production of works which have, for the most part, retained their places in the repertory, and which would accordingly be restored to the original condition of their composition and representation. It would also be more likely to be accepted in other countries than the depression of half a tone." In accordance with the recommendations of the commission, an official order has been issued, establishing by law a uniform pitch to be used by all the musical establishments of France which have any connexion with the government. This "normal diapason" is an A, given by a standard tuning-fork to be preserved at the Conservatoire, which vibrates 870 times in a second, All musical establishments authorized by the state must be provided with a tuning-fork, verified and officially stamped as consonant with this standard. These regulations come into force on the 1st of July next for Paris, and on the 1st of December for the departments.

Such are the energetic steps which the French government has taken in a question which, in our own country, would probably be thought far too trivial to call for state interference of any kind. It would, moreover, in all probability, be almost impossible for us to effect any analogous reformation in the musical world by means of official legislation, inasmuch as we have—and we regret that it is so—scarcely any musical establishments which are dependent for their support upon the government, or which can in any way be said to have a national character. Much, however, might be done by private combination. If such men as Professor Bennett, Mr. Costa, Mr. Benedict, Mr. Alfred Mellon, and Messrs. Broadwood could, upon consultation among themselves and with others of our more eminent musicians and instrument-makers, come to some understanding upon this question, and would offer their suggestions to the world, it would not improbably lead to a reform which, as we have before remarked, is even more pressingly called for in our own country than in France, where the movement has originated. It would, at any rate, be satisfactory to know the opinion of the men who, in England, are best qualified to speak authoritatively upon the subject.

*Gun-making at Woolwich Arsenal.**

Of the innumerable experiments tried during the last two years at Woolwich Arsenal for the purpose of ascertaining the best way to make large guns, *one* good thing has come, at all events—the authorities and ourselves know the proper kinds of iron to use for the purpose. Failures there may have been in the subsequent stages of manipulation, but many guns were certainly cast of the best possible admixture of metal for the purpose. So long back as 1856 iron-masters and others were invited by public advertisement to send to that establishment samples of the iron they could confidently recommend for this particular branch of manufacture. Fifty samples came on this invitation. These were subjected to tests chemical and mechanical in the first instance, and selections were made from them. The result of these primary experiments demonstrated what has subsequently been completely confirmed—that English cold blast pig iron is quite equal in purity and strength to the bulk of foreign iron. Northerton and Parkhead were found in these early trials, indeed, to be far superior to East Indian or Nova Scotian. Swedish grey occasionally proved of very superior character, but generally it seemed extremely hard, and it could not be used, therefore, safely in the composition of guns. The impurities sought for in the chemical testing of the iron were silicon, sulphur, and phosphorus, and if these existed in quantities larger than 1·5 per cent. of the first; ·05 of the second; or ·5 of the third, the iron was uniformly registered. The mechanical tests were applied to ascertain the tensile and transverse strength of the material when cast into bars. Its specific gravity was also taken into account. Without going further into detail, however, upon this interesting subject at present, it may be stated—and there is some satisfaction, in a patriotic sense, in doing so—that the irons peculiarly adapted by nature for the manufacture of large guns are English, and these stand in the following order:—Northerton and Parkhead, Staffordshire; Bowling, Yorkshire; and Blaenavon, Shropshire. The cost of these averages from £6 to £6 10s. per ton, against £8 15s. to £10 per ton for foreign. The charge of metal necessary for the casting of a 68-pound gun, with the "dead heads"—the latter is used, however, in the charge for the next gun to be cast—is 8 tons or thereabouts, and the conveniency of using English irons, with the certainty that they are the best, becomes thus apparent. Whether the Arsenal will yet be able to *finish* these weapons in a style equal to that of certain contractors is, we believe, a problem yet to be solved.

Manufacture of Horn by Rolling.†

M. Possoz, of Ixelles, Belgium, has lately suggested the adoption of a combined softening and rolling process for working up horn into various articles and shapes. As a primary treatment, the horn is sub-

* From the Lond. Mechanics' Magazine, April, 1859.
† From the Lond. Practical Mechanics' Magazine, April, 1859.

jected to the action of a hot bath, being kept at a constant temperature by a jet of steam at a pressure of sixty or seventy pounds. In this way, the very heart of the horn is penetrated, and the material is rendered fit for undergoing the rolling or laminating process. When withdrawn from the baths, the pieces of horn are forced on to conical mandrils, for the purpose of straightening them. In this condition the horns remain until sufficiently hardened, when they are taken off the mandrils and split longitudinally into two halves, either by a circular rasp or by a cutter. The horns are again placed in the hot bath for a second softening, and afterwards in a cylindrical wrought iron vessel, formed with a double bottom and filled with oil, into which a jet of steam is introduced. This vessel is worked under a high steam pressure as in the former case, and the horn is now rendered supple and soft and fit for the rolling operation. The "grain" of horn always runs straight, that is to say, the fibres are parallel to each other in the length of the individual horns; and consequently, when rolled, these fibres are all lengthened and compressed, and thus the material preserves its elasticity and solidity. When umbrella and parasol ribs are to be made, this rolling system affords peculiar facilities for the purpose; the whole process, in fact, does for horn what has been so well accomplished for iron.

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*Large Specimens of Titanium.**

At the Manchester Literary and Philosophical Society, Mr. Wm. Brockbank exhibited some large specimens of titanium, which have recently been found in considerable quantities, filling the crevices and under the hearths of the fire-brick linings of the furnaces of the Hematite Iron Company, of Whitehaven. In one instance it occurred in a large mass weighing nearly 4 cwts., under the furnace hearth, having found its way through the crevices between the fire-bricks. Smaller masses, weighing from 50 lbs. or 60 lbs. to a few ounces, were found filling the hollows and crevices in the lining of the furnace, around that part which holds the molten metal. The occurrence of titanium in such large quantities is a new and interesting circumstance, previous instances being confined to a few furnaces in South Wales (where hematite ore is used as a mixture), and to some in the Hartz mountains, in both of which cases the specimens found were comparatively small. Small crystals of it have long been found in the slags of many iron works. Should any commercial use be discovered for titanium, it could be supplied in considerable quantities.

* From the Lond. Mining Journal, No. 1227.

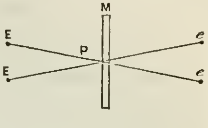
For the Journal of the Franklin Institute.

Experiment in Binocular Vision, elucidating the Principle of the Stereoscope.

A familiar experiment in binocular vision elucidating the principle of the stereoscope, and one which I have never seen alluded to, is

obtained by looking into a mirror and concentrating the ocular axes upon any spot on the surface of the glass, of an equal elevation with the eyes. If no such spot exists it can readily be supplied by wetting a piece of paper or wafer the size of a pea.

The reflected images of the eyes being as far behind the glass as the eyes are before it, and equidistant from each other, the ocular axes concentrated upon the surface of the mirror will, if produced, cross and precisely meet them, producing in the centre of the forehead one large cyclopian eye.



Referring to the figure, let M be a mirror, E E the eyes, *e e* their images, P a piece of paper upon which the eyes are concentrated.

The ocular axes crossing at P, combines the images, *e e*, into one eye, which will appear in the middle of the nose at that point. W.

Germantown, Penna.

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*Expectation of Life at any Age from Five to Sixty Years.**

Every man, woman, and child has a property in Life. What is the value of this property? Mr. Charles M. Willich has established an extremely easy rule for expressing this value—this "*Expectation of Life*" at any age from five to sixty. His formula stands thus: $e = \frac{2}{3}(80 - a)$; or in plain words, the expectation of life is equal to two-thirds of the difference between the age of the party and eighty. Thus, say a man is now twenty years old. Between that age and eighty there are sixty years. Two-thirds of sixty are forty:—and this is the sum of his expectation of life. If a man be now sixty years he will have an expectation of life nearly fourteen years more. By the same rule, a child of five has a lien on life for fifty years. Every one can apply the rule to his own age. Mr. Willich's hypothesis may be as easily remembered as that by De Moivre in the last century, which has now become obsolete, from the greater accuracy of mortality tables. The results obtained by the new law correspond very closely with those from Dr. Farr's English Life Table, constructed with great care from an immense mass of returns.

A Simple Means of Demonstrating the Working of Liquid Fire-shells.†

The bi-sulphide of carbon is first poured into the shell, and then small bits of phosphorus are dropped in; the mouth of the shell is then closed with a cork, partly projecting, like the cork in a wine-bottle. The shell may then be laid on canvass, or other combustible matter; and in about ten minutes, the fermentation of the mixture will force its way through the pores of the cork, and, meeting the

* From the Lond. Athenæum, Feb., 1859.
† From the Lond. Mechanics' Magazine, April, 1859.

oxygen of the atmosphere, will become ignited; the cork acting like the wick of a candle, and the liquor underneath feeding it. A leaden shell thus charged, and adapted to the Lancaster military rifle, will continue to burn for ten minutes with an inteuse flame which cannot be extinguished by water.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 18, 1859.

John C. Cresson, President, in the chair.

John Agnew Vice-President. } Present.
Isaac B. Garrigues, Recording Secretary. }

The minutes of the last meeting were read and approved.

Letters were read from the Royal Society of London; the Commissioners of Public Schools, Baltimore, Maryland; and the American Oriental Society, New Haven, Connecticut.

Donations to the Library were received from the Royal Society, and the Royal Astronomical Society of London; the Smithsonian Institution, and Lieut. M. F. Maury, U. S. Navy, Washington, D. C.; the Regents of the University of the State of New York, Albany, N. Y., and the Mutual Life Insurance Co., City of New York; the American Oriental Society, New Haven, Connecticut; the Maryland Institute, Baltimore, Maryland; Dr. Charles M. Wetherill, Lafayette, Indiana; and from Charles E. Smith, Esq., and J. J. Barclay, Esq., Philada.

The Periodicals received in exchange for the Journal of the Institnte, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of July was read.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (5) were proposed, and the candidates (8) proposed at the last meeting were duly elected.

Two tubes taken from the Pirsson's fresh-water condenser of the steamer *Keystone State*, were laid upon the exhibition table, for the inspection of the members. Six months ago, after a use of several months, many of the original tubes were found to be much injured by the action of sea water; owing to an impure copper having been used in their manufacture. The builders of the *Keystone's* machinery determined to coat the new tube with either zinc or tin, giving zinc the preference, on account of its superior conducting power, though more subject to the chemical action of sea water. However, some of the tubes were coated with tin. and the balance with zinc; and were put into the condenser side by side. The tube heads were of copper, and the external casing of cast iron. A tube of each sort was placed before the meeting. The one coated with tin was perfect as when first put in, with the tin still remaining; whilst that coated with zinc was much corroded, particularly near the ends where it approached the tube heads;

and the heads themselves were eaten away at the places of contact. Thus, the coating of tin seems to be the best preservative of the tubes, and as no falling off of the vacuum took place from the lower conducting power of that metal, another example is brought forth to prove the statements made by Mr. Pirsson in regard to his condenser. (See *Jour. Frank. Inst.*, vol. xxxvi., 3d Series, page 234.)

COMMITTEE ON SCIENCE AND THE ARTS.

Report on J. W. Fawkes' Steam Plough.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination "a Steam Plough," invented by J. W. Fawkes, of Christiana, Lancaster Co., Pennsylvania,

Report:—That they have examined the machine and witnessed its operation in the field.

The plan of construction appears to be as simple as the case admits. A pair of horizontal engines connected on one shaft by cranks at right angles, propel the machine over the ground, by means of a double gearing, which reduce the velocity of the driving-wheel to one-sixth that of the cranks. The steam cylinders are 9 inches in diameter, and 15 inches length of stroke.

The driving-wheel is a strong drum, six feet in diameter, and six feet long; the large surface of which enables it to run on soft ground. The steering wheels are $3\frac{1}{2}$ feet diameter and 15 inches wide, and are placed 54 inches distant apart.

The axle on which they are placed is guided by a steering wheel geared into a tangent screw.

The ploughs, eight in number, are suspended by chains from a framed outrigger projecting in the rear of the machine, and can be raised entirely out of the ground, by chains working over small barrels, which can at will be connected to the engine by sliding clutches.

The arrangement of the ploughs is such as to allow them to follow in a regular succession at the proper lateral distance for the furrow.

When working at a speed of about three miles an hour, the eight furrows were turned with great ease and completeness. The work was not as smooth as to satisfy a Pennsylvania ploughman, owing to the form of the ploughs, which is such as is said to be preferred for breaking up prairie land, for which this machine is especially designed. It appears to be capable of breaking up land at the rate of three or four acres per hour.

In the opinion of the Committee, its great simplicity of plan and efficiency in working, entitle it to strong commendation, and make it worthy of the Scott's Legacy Medal, the award of which is accordingly recommended.

By order of the Committee,

Philadelphia, August 9, 1859. Wm. Hamilton, *Actuary.*

Abstract of Meteorological Observations for June, 1859; made in Philadelphia, Somerset, Dauphin, and Centre Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

1859.	PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 76° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.									SOMERSET, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.						HARRISBURG, Dauphin Co. 40° 16′, N. 76° 15′. W. JOHN HEISELY, M D., Obs.				FLEMING, Centre Co. Lat. 40° 55′ N. 77° 53′ W. Ht. 780 ft. S. BRUGGER, Obs.		
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain.	Prevail'g winds.	Bar.	Ther.	Relative humidity.	Force of vapor.	Rain.	Prevail'g winds	Bar.	Ther.	Rain.	Prevail'g winds.	Ther.	Rain.	Prevailing winds.
June.	Mean.	Mean daily range.	Mean.	Daily oscillation.	Mean daily range.	2 P. M.	2 P. M.			Mean.	Mean.	2 P. M.	2 P. M.			Mean.	Mean.			Mean.		
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.	Direc.	Inch.	°	Per ct.	Inch.	Inch.	Direc.	Inch.	°	Inch.	Direc.	°	Inch.	Direc.
● 1	29·982	·060	68·0	13	4·2	76	·617	0·800	S S E.	27·734	69·3	65	·625		(var.)	29·845	71 7	1·423	S W.	69·3		(var.)
2	29·908	·075	76.5	20	8·5	67	·689		S S W.	27·702	69·3	69	·664		(var)	29·768	77 3		S W.	75·7	0·500	N W.
3	29·744	·164	72 5	14	4·0	74	·757	0·839	S S W.	27·652	63·7	56	·483		W.	29·647	76·7		W.	68·0		N W.
4	29·898	·154	56·3	14	16·2	63	·282		N W.	27·779	42 7	68	·294		N W.	29·855	55·7		N W.	46·7		N W.
5	30·011	·113	57·0	21	6·7	37	·215		N W.	27·826	47·0	52	·242		N W.	29·928	58·3		N W.	62·0		N W.
6	30·037	·050	68·4	20	7·8	38	·295		(var.)	27·832	56·7	45	312		(var.)	29·985	65·3		S W.	63·0		S E.
☽ 7	30·086	·050	65·7	24	2·2	29	·255		S W.	27·783	62·7	62	·469		S W.	29·964	68·0		S W.	65·7		(var.)
8	29·798	·288	72·7	20	7·0	64	·600		S S W.	27·611	64·3	81	·509	0·496	WSW.	29·665	71·3	0·089	S W.	67·0	0·345	W.
9	29·835	·136	66·5	16	6·2	37	·278		N W.	27·674	59·7	61	·448		(var.)	29·752	67·7		N W.	62·0		S W.
10	29·804	·065	67·8	25	7·0	49	·533	0·348	S W.	27 654	56·0	80	·436	0·313	W.			0·080	(var.)	56·3	0·100	N W.
11	30·072	·268	58·0	20	10·2	37	·215		N W.	27·849	48·7	56	·311		(var.)	30.026	58·3		N W.	57·0		(var.)
12	30 109	·037	63 2	24	5·2	42	·315		S W.	27·803	61 7	52	·469		S E.	30·000	63·3		S.	60·3		S W.
13	29·969	·140	69·7	24	6·5	76	·641	0·108	S S W.	27·720	66·3	68	614	0·508	(var.)			0·590	(var.)	65·3	0·335	W.
14	29·858	·111	77·7	10½	8·0	79	·890	0·377	S W.	27·737	70·7	71	·671	0·065	(var.)	29·798	78·0		S W.	72·0		W.
○ 15	29·760	·098	82·3	22	4·7	53	·750		S W.	27·644	73·3	63	·662	0·258	S W.	29·662	79·7		S W.	76·3	0·120	S W.
16	29·694	·067	79·7	14	2·7	55	·704	0·138	S W.	27·568	67·0	62	·525		W	29·577	78·3		S W.	67·3		W.
17	29.623	·076	63·8	16	12·5	92	·556	1·475	N N E.	27·461	61·3	75	·529	0·180	(var.)	29·528	66·3	0·608	(var.)	61·3	0·420	E.
18	29·710	·105	69·2	20	5·3	45	·369		(var.)	27·571	59·0	52	·339		N W.	29·637	70·3		N W.	57·0		N W.
19	29·851	·141	71 3	23	2·2	38	·354	0·278	S W.	27·662	57·7	91	·429	0·376	(var.)	29 774	67·7		W.	63 0		(var.)
20	29 704	·147	66·8	11	5·2	84	·577	0·403	S W.	27·510	68·0	82	·785	0·175	WSW.	29·565	75·0	0·078	S.	74·0	0·500	S W.
21	29·541	·163	75·3	22	8 5	64	·717		S S W.	27·443	67·3	43	·429		W.	29·456	76·7	0·578	W.	68 3		W.
22	29·635	·094	73·7	14	1·7	65	650		WNW	27·544	63·7	52	·469		(var.)	29·574	76·0		W.	67·7		W.
☾ 23	29 829	·195	70·7	15½	3·0	67	·619		(var.)	27 665	61·7	59	·423	0 865	N E.	29·742	77·0		W.	62·7		(var.)
24	29·856	·027	68·0	9½	3·3	85	·621	0·025	(var.)	27·672	64·0	73	·522	0·398	NNW.	29·776	72·7		E.	69·3	0·680	(var.)
25				16½					(ver.)	27·741	61·3	61	·448		(var.)	29·786	77·0		N W.	73·0	0·430	(var.)
26	29·972		80·0	23		45	·525		S W.	27·800	72·0	54	·648		N W.	29·882	77·0		W.	70 3		S W.
27	30·038	·066	76·2	24½	1·5	40	·484		S W.	27·805	75·0	61	·761		(var.)	29·930	79·3		S W.	74 7		S E.
28	29 993	·045	79·2	26½	3·7	69	·881		S W.	27·808	77·7	64	·774		(var.)	29·885	81·7	0·810	S.	79·3		S W.
29	29 812	·181	84·8	25½	6·7	50	·964	0·438	S W.	27·737	76·3	59	·808	0·230	W.	29·732	85·3	0·040	S W.	82·3	0·490	(var.)
● 30	29·828	·145	73·7	17½	11·2	37	·335		N W.	27·760	63·7	63	·531		N W.	29·780	70·3		N W.	65·7		N W.
Means	29·861	·116	70·8	19	6·1	67	·541	6·229	S71°W.	27·691	63·6	63	·518	3·864		29·768	72·4	4·296		66·4	3·915	

JOURNAL
OF
THE FRANKLIN INSTITUTE
OF THE STATE OF PENNSYLVANIA,
FOR THE
PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1859.

JOURNAL OF THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1859.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Steam and its Condensation. By Thomas Prosser, C. E.

(Continued from page 80.)

CHAPTER VIII—PART II.

The second part of my subject—the surface required for the condensation of steam—was not determined by the *experiments*, further than the previously recorded fact, that it was greatly exceeded in the apparatus used; it amounted to 47 superficial feet, or nearly half the boiler water-heating surface. I have no doubt that, with thin steel, instead of iron tubes, one-fifth will be found sufficient. The foundation of this belief is to be found in the fact that, when the condensing water was at 55° F., the steam water* was frequently below 100° F., instead of being about 200° F., which is the ordinary temperature.

If the steam-water can be forced into the boiler at this latter temperature, the heater-condenser may be dispensed with; but, to insure the action of the feed pump, it appears desirable that the water in the reservoir be at a temperature of some 20° to 30° F. below that of the superincumbent steam, for the purpose of insuring solid water.

* I beg leave to be allowed the use of the following terms for the sake of brevity, and to avoid repetitions:

Steam-water	for condensed steam or water of condensation.
Pistonage	for the steam space displacement of the piston.
Clearance	for the space at each end of the cylinder beyond the piston range.
Passages	for the steam passage from the cut-off to the cylinder.
Leakage	for the steam leakage by the piston and exhaust port.
Total Power	for the mechanical power developed by converting one pound of water from the boiling point into steam.—See this *Journal*, vol. xxxvi. (3d Series), p. 7.

Still it may be a question whether, on board a ship, it is worth the space occupied; *I* believe it will always be found so, as the space over the distilling condenser can seldom be appropriated to any other purpose; and, moreover, the apparatus appears not liable to the least deterioration, or to give the slightest trouble, so far. In fact the whole condenser and boiler may claim the same immunity; for, after eighteen months in one case, and more than two years in another, of constant use, not the slightest trouble or difficulty of any kind has occurred.

One-tenth part of the boiler water-heating surface will be sufficient for the heater-condenser, and the same for the still-condenser, of a sea-going steamer requiring distilled water for the use of the ship.

These questions, however, have not been determined experimentally, on account of the want of steam to test the power of the condenser, and therefore some modification may be found desirable hereafter; but the paramount consideration, *the supply of distilled water to recuperate the waste from the boiler*, is placed beyond a doubt, even if that waste, including as it does all the steam condensed in the cylinder, be three times the amount which we know it has not exceeded. It may surprise many to be told what the amount of this waste of boiler water really is. In the "*Fulton*" and "*Arago*" I have the best authority for stating it to be 25 per cent., for their surface condensers would supply but three out of the four boilers with fresh water, even when the boilers and condensers were comparatively new.

Of the "*San Jacinto*" with her old copper boilers "in good condition,"* and not two years old, and with new condensers, it was said, "The condensers *performed well*, furnishing *more* than enough fresh water for two out of the three boilers."† I quote the exact words which will some day be read with astonishment. If this is "*performing well*," it makes rather an interesting inquiry of what performing bad means.

How much more than two-thirds of the steam was returned to the boiler as fresh water, we are not informed, but presume it was not three-fourths. In fact these expensive boilers were a wreck in four years afterwards,‡ having been in commission but five and a half altogether.

This waste of water is almost entirely from the boiler. The steam-water from condensation in the cylinder is too valuable to be thrown away, and as to superheating the steam sufficiently to prevent it, that is impossible, without incurring the greatest danger and encountering difficulties as great if not greater than that to be overcome.

The first part of this chapter closed with showing an evaporation equivalent to 12 pounds of water with 1 pound of coal. Of that 12 pounds of water, however, I claim but 10 pounds as *bona-fide steam*, after it had left the cylinder *and entered the condenser*. It does not follow, however, that the remaining 2 pounds were wasted, and therefore have to be restored to the boiler, for the half of that had its equivalent in superheat of the steam, and therefore we have only actually to provide for the other half, or about 8·2 per cent., which, as before

* Jour. of Franklin Inst., vol. 28 (3d Series), p. 128.
† Ibid, p. 130. ‡ Ibid, vol. 38 (3d Series), p. 8.

stated, was the real deficiency of every kind and from every source, a deficiency which is less than *one-third* the ability of the distilling condenser to make good.

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CHAPTER VIII—PART III.

Having disposed of the equivalent of one pound of water converted into steam, as superheat in the whole body of the steam generated, and of one pound of water which disappears, whether as water or as steam, we come to that of the ten pounds of *pure steam* as I contend the remainder to be. If not *pure steam*, the test to which I shall submit it will soon discover it, and, at the same time, fully test the accuracy of the forthcoming Report of the Board of Inquisition, for that in its most objectionable form is its character.

Personally, I have the greatest respect for the individual members of that board, and for the faithful and able manner in which the experiments were conducted. But the objectionable part of the proceedings is (in accordance no doubt with red tape precedents and official dignity) that the Report, instead of being submitted to the person supposed to be *individually* more particularly and understandingly interested therein than any other, is "*hid from his sight*," and sent off to one who is not necessarily supposed to know or to care anything about it; so that if there are any damning errors in the Report, they are discovered too late to be amended, and "*Ruin*" may sign as one of the board. Is it too much to imagine that a Board composed of U. S. Marine Engineers may fail to appreciate at its true value, an invention necessarily new, unknown and untried, which upsets the whole theory in which they have been educated, and sacrilegiously tears away the air-pump from the shrine in which its idolizers have placed it? Had there been discussion in open court on all debatable subjects, surely the Report could not have suffered in efficacy from that cause, and I should have no need to lay this anchor to windward. As I do not intend to leave anything to mere imagination, I have carefully measured the cubical contents of the steam engine, for the purpose of ascertaining the amount of steam, that is to say of the ten pounds which is effective, premising that, excepting the salvage of the exhaust steam, all which is used in clearance and passages is *lost*, whether working with or without expansion, provided the calculation be made at the end of the stroke.

The cut-off does not entirely regulate the expansion, but it is the whole steam which passes it up to the period of cutting off, and which of course includes not only the due portion of the pistonage, but also that of the whole of the clearances and passages.

In the case in question the steam was cut off at 5·076 in. of the 18 in. stroke, or as 1 to 3·5461, but the real steam expansion is as 1 to 2·778527. The former represents, at the moment the steam is cut off, the proportion which the pistonage then bears to the whole pistonage, viz: as .2909757 ft. to 1·0318288 cubic feet, while the other represents the proportion which the whole steam which has passed the

cut-off valve at the same moment, bears to the whole capacity of the cylinder, clearances and passages combined, viz: as ·4165543 ft. to 1·157407 cub. ft.

Without expansion the "*abstract* practical value" of the steam which it is the object of this portion of our paper to elucidate, is reduced by three causes. First, the clearance and passages; second, the leakage; and third, the back pressure of the steam upon the piston.

	Cub. in.		Cub. ft.
The Pistonage per double stroke is . .	1783	=	1·0318288
" " clearance, and passages,* .	87	=	·0503472
Totals,	1870	=	1·0821760

The steam engine made 21,600 double strokes (in 8 hours) with 2565 lbs. of steam, that being the weight of steam-water actually caught.

It was found upon trial with the fly-wheel of the engine scotched, that, about five per cent. was lost by leakage. We have therefore to account for ninety-five per cent., or 2436·75 lbs. of the steam-water, as having been working steam, and therefore

$9{\cdot}5927 = \left(\frac{1{\cdot}0821760,21600}{2436{\cdot}75}\right)$ cubic feet of such working steam weighs 1 lb., corresponding with 45·5 lbs. per square inch of pressure, and 135° C. of temperature.

Steam at this pressure has a total power equal to lifting 1 lb. 62·916 feet, but only $\cdot953477 = \left(\frac{1{\cdot}0318288}{1{\cdot}0821760}\right)$ of it is available.

The back pressure upon the piston was 16 lbs. per square inch, which leaves an unbalanced steam pressure of $29{\cdot}5 = (45{\cdot}5 - 16)$ lbs. per square inch; so that even of the working steam, only $\cdot648352 = \left(\frac{29{\cdot}5}{45{\cdot}5}\right)$ is available in *work done*, or of the whole working steam effective in work done $\cdot618188 = (\cdot953477 \times \cdot648352)$. Taking the whole 10 lbs. of steam which entered the cylinder, only ·5872786 was available in *work done*. Hence we have H. P. $11{\cdot}1966 = \left(\frac{\cdot5872786,62,916}{33,000}\right)$ from the evaporation of 10 lbs. of water with 1 lb. of coal per minute. This is but ·893122 lbs. of water per minute per H. P.

The coal was therefore 5·35873 lbs. per hour per H. P., and, as the coal used was 32 lbs. per hour, the power developed was $(32 \div 5{\cdot}35873) = 5{\cdot}97156$ H. P.

In order to show the extravagance in fuel by using steam of so low a pressure, we will calculate the known certain effects of applying the steam at 160 lbs. pressure per square inch, with the same back pressure as before, viz: 16 lbs. to the square inch.

We have available as before ·953477, and hence

H. P. $17{\cdot}4115 = \left(\frac{\cdot953477,\ \frac{144}{160},\ \cdot95,\ 70,481}{33,000}\right)$ The total power at this pressure is equal to lifting 1 lb. 70·481 feet, ·95 of which is available

* There is a salvage from this in the exhaust steam, which I have not thought worth deducting.

as before. Now, 17·4115 H. P. by the evaporation of 10 lbs. of water with 1 lb. of coal, is ·57433 lbs. of water per minute per H. P.

The coal 3·446 lbs. per hour per H. P.; and, as that is calculated as before at 32 lbs. per hour, the power developed is $(32 \div 3{\cdot}446) = 9{\cdot}2861$ H. P., or more than 50 per cent. of increase, by merely increasing the pressure of the steam, which pressure is perfectly safe, as any competent person will declare, after an examination of the boiler.

Comparative Analytical Development of Power by the Two Pressures.

Full pressure of the working steam per sq. in. in lbs.,	45·5	160
Unbalanced pressure of the working steam "	29·5	144
Loss by cylinder leakage, . . .	·50	·50
" " passages and clearances, .	·44	·44
" back pressure upon piston, . .	3·19	·91
Available in *work done*, . . .	5·87	9 13254
		10·98254
Gain in total power, by increase of pressure, .		·98254
Total cost,	10.	10.

I must now close this chapter, reserving for another the consideration of expanded steam, which is of sufficient importance to claim one to itself.

(To be Continued.)

*Simple Method of Calculating Earthwork.**

To the Editor of the Civ. Eng. and Arch. Journal.

In your May number, A. S. W. describes a method of calculating the contents of cuttings, and asks if it has ever been previously used. I may inform you that the same method has been used by me for some years, but I never looked upon my application of it as a *discovery*, for I thought it would be sufficiently obvious to any person with a slight knowledge of mathematics, who might have frequent occasion to measure irregular solids.

The method was first suggested to me in 1846, when investigating the proper system of ascertaining the cubic contents of walls built to

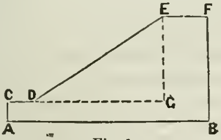

Fig. 1.

Fig. 2.

support the slopes of embankments. I was then engaged in forming reservoirs at Whittle Dean, for the water supply of Newcastle-upon-Tyne. The walls of our grating tanks were of the form shown in the two figures: Fig. 1 being an elevation of the wall, and Fig. 2 a section of the same at E.

* From the London Civ. Eng. and Arch. Jour., July, 1859.

The upper surface of the walls, or where they coincided with the slope of the embankment, as on C, D, E, F, was of uniform breadth, the face was perpendicular, and the back battering. In measuring the contents of the triangular portion D, E, G, it seemed at the first glance that a near approximation would be attained by multiplying the length D G, by half the height E G, and this again by an average thickness found by taking one-third of the sum of the thicknesses at the angles. I soon found that not an approximation only, but the exact contents was the result. Subsequent investigation showed me that this method was coincident with, and directly deducible from, the prismoidal formula.—For let us call a, b, and c, the thickness at D, E, and G respectively, l = the length D G; h = the height E G.

For wider application I take a different symbol for the thickness at each angle. Then "*the sum of the areas of the ends added to four times the area of the middle section, and multiplied by one-sixth of the length will give the contents.*"

Area at D $= a \times o = o$. Area at E G $= \frac{b+c}{2} h$.

Four times area of middle section $= 4 \times \frac{1}{2}\left(\frac{a+b}{2} + \frac{a+c}{2}\right)\frac{h}{2} = \left(a + \frac{b+c}{2}\right)h$

$$\text{Content} = \left[o + \left(a + \frac{b+c}{2}\right)h + \frac{b+c}{2}\ h \right] \times \frac{l}{o} = \frac{a+b+c}{3} \times \frac{l\,h}{2}$$

which last expression is the method of A. S. W.

The prismoidal formula admits of very wide application, and I find it useful in calculating the contents not only of cuttings, but of conic and pyramidal frustrums, and in various ways.

Hexham, May 10, 1859. T. D. Ridley.

The applicability of the prismoidal formula to cones, wedges, spheres, &c., is shown by Mr. Ellwood Morris, Civ. Eng., of Philadelphia, in the *Journal of the Franklin Institute*, vol. xxiii, page 241, year 1852. The application to embankments and excavations, the measurements of masonry, &c., has been general on our public works from the date of their commencement. *Ed. Jour. Fr. Inst.*

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*On the Relative Values of Coke and Coal in Locomotive Engines.**
By Benjamin Fothergill.

(Continued from page 154.)

Mr. John Braithwaite, having been called upon by the Chairman, said that having the intention at some future time to bring forward some views of his own in reference to combustion, he must decline entering fully upon the subject that evening. He had listened with attention to the remarks of the last speaker, and there were several of his views which, in the paper that he hoped to be allowed to bring before the Society at a future period, he should endeavor to controvert. Whether it was a question of using coal or coke, he believed

* From the Jour. of the Society of Arts, No. 339.

the present arrangement of furnaces and the manner of producing combustion were very far behind what he hoped would ultimately be arrived at. He thought that, ere long, the boilers of engines would be constructed of a different form, so as to produce more efficiently the draft in the furnace, not precisely after the plan which he (Mr. Braithwaite) brought forward in 1829, but such an improvement upon it that the combustion would be steadily carried on and the gases essential to the generation of steam would be given out without the use of the diffuser to which allusion had been made. This principle had been carried out in the caloric engine, and had been found, so far, successful.

The CHAIRMAN was gratified to hear that it was Mr. Braithwaite's desire to give them the benefits of his practical experience in these matters.

Mr. BRAITHWAITE would be glad to do so, and for that reason he would not then forestall any thing he had to say.

Mr. JOHN BETHELL, being called upon by the Chairman, said he did not feel himself competent to say much upon this point, because the paper was chiefly directed to locomotive engines, of which he had had little or no experience. He might, however, make an observation with reference to the general question as to the comparative merits of coal and coke. He confessed he did not think the paper had sufficiently entered into it. Some years ago it was stated at the scientific institutions, that the coke made from a certain quantity of coal would give the same amount of heat, and evaporate just as much water, as the coal from which it was made. He believed that was a theory which was advocated in that room some years ago, by his friend, Mr. George Lowe. He (Mr. Bethell) confessed he was astonished at that theory, for when they observed the great heat that was generated in converting coal into coke, it seemed very remarkable that the coke should, after being subjected to that process, give as much heat as the coal itself. He had burned many thousand tons of fuel in the stationary engines of his manufactories, and after some consideration of the subject it was clear to him that the difference arose entirely in the mode of burning the fuel. It was possible, no doubt, to construct a furnace which would give coal no advantage over coke. The real point was, the proper construction of the furnace. It was excessively simple to burn coke when operated upon by a strong draft, so as to get all the heat out of the carbon which it contained; but it was not so simple to burn coal, because this involved two operations; they had to burn the gases, which required one mode of treatment, and the carbon, or coke, which required another mode of treatment. He confessed he had not yet seen any plan which, in his opinion, was perfect for carrying out his ideas of burning all the gas and all the carbon. The plan laid before them that evening appeared to him very complicated. In France and Belgium, where they burnt a great deal of coal, as well as a patented fuel which contained more gas than coal, they had a simple apparatus for doing it, and they carried out the process in the locomotive engines without producing so much smoke

as he had met with on railways in this country. He would not then describe it in detail, but it was a simple arrangement of the fire-box, which allowed air to pass in over the fire. He had hoped the paper would have gone more into the general question, and not have been confined to one description of locomotive. There were many locomotives as well as fixed boilers working in this country, in which various plans were adopted, by which the gas from coal was more or less burnt, though not always efficiently. With regard to the analyses before them, he confessed he was astonished at them, and he could hardly believe them to be correct. It was easy to take an analysis of the composition of coal, but the ascertaining how much water a certain fuel would evaporate was a different matter, as apparatus specially adapted to the different kinds of fuel was necessary in order to obtain reliable results. If they were using an apparatus to burn coal which contained the gases as well as the carbon, they must have an apparatus in which the air came over the fire, and if the same apparatus was used for burning coke it would not answer. Hence they found it stated in the table before them that 1 ℔. of Ramsay's coal evaporated 15 ℔s. of water, whereas 1 ℔. of coke evaporated only 12 ℔s. of water. He believed if the coke were used with a proper apparatus it would evaporate more. Again, they found it stated that the Merthyr coal, which contained 89 per cent. of carbon and 4 per cent. of hydrogen, or 93 per cent. of heat-giving properties, evaporated only 14 lbs. of water per pound of coal, whilst Ramsay's coal, which contained only 90 per cent. of heat-giving properties, evaporated 15 ℔s. of water. That, to a theoretical man, seemed an absurdity, and showed that in all experiments as to using fuel for the evaporation of water, everything depended upon the manner in which the fuel was used. The Welsh coal owners had, for a long time, contended that their coal would evaporate a larger quantity of water than the Newcastle coal; latterly, however, the Newcastle gentlemen had asserted that their coal would evaporate more water than the Welsh coal; but, to his mind, such statements ought to have no weight unless each description of coal was used with an apparatus especially suited for it. Then came the question, whether the apparatus which was suitable for any particular description of coal could be practically adapted for general use with steam boilers. That was a matter which they all knew to be one of considerable difficulty. They could easily construct a small experimental apparatus, but they might not be able to apply it when coal was burnt in masses for heating large boilers. He did not think the meeting was in a condition to argue this question upon the data given in the paper before them, or to enter into it in a way that its great importance deserved.

Mr. George Lowe, F. R. S., said, although he was not a locomotive engineer, yet he had been connected with the combustion of coal and coke in London for the last thirty years. He agreed with Mr. Bethell that there were anomalies in the tables before them, which were most perplexing. Some of those anomalies had been already referred to, and in one instance it was evident that there was some

mistake, viz: in the statement that there was more sulphur in coke after it had undergone the carbonizing process than in the coal itself. As gas men they knew that when the gas was evolved from the coal a certain amount of lime was wanted to get rid of the sulphur which came out of the coal during the process; and therefore he thought there must be some error in the analyses before them. The point, however, to which he most desired to address himself was with reference to a statement which Mr. Bethell had noticed as having been made by him (Mr. Lowe) on the occasion of the reading of a paper upon this subject by Mr. Apsley Pellatt when he had the honor of occupying the chair. On that occasion he begged to state he gave the general opinions of the books—of the schools—rather than his own. They all looked up to Mr. Apsley Pellatt as a tolerably good chemist and a close reasoner, and that gentleman's experiments upon the relative value of coal and coke for the purposes of his immense manufactory had been of the most beautiful and satisfactory kind. Mr. Apsley Pellatt would work one week or a fortnight with coal and the next with coke made from the same amount of coal, and he had shown that in every instance the work in his manufactory was done as well with the coke produced from a ton of coal as with the coal itself. There were eminent French chemists who confirmed Mr. Pellatt's views, which were further confirmed by some experiments made at Philadelphia; and it was to be remarked that whilst Mr. Apsley Pellatt was working upon a large scale, the French chemists on small scale in a laboratory, and the Americans on another scale, and he (Mr. Lowe) was also making his own experiments, the results of all these trials seemed entirely to coincide. He would now say a word or two upon the best mode of conducting the combustion both of coal and coke. The English locomotive had done great credit to the skill of our engineers, as was proved by the fact that as much as 10 lbs. of water was evaporated with 1 lb. of coal; and there was every hope that much higher results would eventually be obtained. Some of the experiments recorded by Mr. Fothergill were made as far back as 1855; but the French engineers, during the last two years, had made immense progress in the successful introduction of coal into the locomotive engine. After all, the great thing was how to conduct the combustion so as to make use of all the heat-giving properties contained in 1 lb. of coal. Mr. Bethell had, no doubt, hit the point in stating, that it was absolutely necessary that a certain amount of air should go over the fire, as well as through the furnace, to produce the proper combustion of coal. Very little air was wanted to go over the furnace if they used coke, but if they used coal, then a certain amount of atmospheric air must go over the furnace so as to combine with, and promote the combustion of, the hydro-carbons and other inflammable matters, which, if they got so far as the chimney, went off in smoke and were lost. The great object was to prevent smoke and produce heat. Many years ago his (Mr. Lowe's) father conducted one of the largest malting establishments in the country, and the whole of the heat in the kilns was produced by the bituminous coal of Derbyshire. All the products of combustion went through the kiln, and if any

smoke had been produced, five minutes would have sufficed to destroy a very large quantity of malt. For the last thirty-five years there had not been a furnace erected by him, in any part of the world, from Lima to Calcutta, in which the principle of letting a certain amount of atmospheric air pass over the surface had not been adopted. Mr. Lowe directed attention to a model of a furnace designed by him, in 1828, which had remained in Berlin for many years, and in which this principle was shown. He concluded by expressing a hope that Mr. Fothergill would, at some future time, favor them with a further paper upon this important subject.

Professor JOHN WILSON, F.R.S.E., would refer to the comments of Mr. Bethell, in which that gentleman challenged the correctness of the analyses given in Mr. Fothergill's tables. He apprehended that Mr. Bethell imagined these to be practical results, but he (Professor Wilson) believed them to be merely theoretical calculations, based upon the possible evaporating power of coal depending on the quantity of carbon and hydrogen it contained. In No. 1 of the tables, the amount of carbon and hydrogen contained in the coal was 90 per cent., and in No. 3 the amount of those elements was 93 per cent., and yet the combustion of the latter gave a smaller amount of evaporating power than the lesser proportion of carbon and hydrogen in No. 1. If Mr. Bethell would bear in mind the vast difference between the power of hydrogen and the power of carbon to generate heat, he would readily be able to reconcile the difference in the results obtained in the two cases, which depended on the atomic proportions in which these two substances combined with oxygen. He thought, therefore, the surplus of carbon in the second case would be more than sufficient to account for the difference between the quantity of water evaporated by the two qualities of coal respectively. This brought him to a point mentioned in Mr. Clarke's letter, in which that gentleman spoke of the difference between coal which was suitable for locomotive engines and that from which coke was made. He stated that the bituminous coals were not those best suited for these engines. If his (Professor Wilson's) idea was right, as to the value of fuel depending upon the amount of hydro-carbons it contained, then the more highly bituminous the coal was the greater would be its evaporative power. Therefore, if they burnt coal they ought to get that which contained the largest amount of bituminous matter, in preference to that from Wales known as steam coal. Having defended Mr. Fothergill's analyses so far, he would now begin to challenge them himself. There was one point which struck him as rather curious. He could reconcile the difference in the relative quantities of sulphur in coal and coke, for when, as had been stated, it took $1\frac{1}{2}$ tons of coal to make a ton of coke, it was possible that an extra amount of sulphur might exist in the coke; but he could not understand how coal containing 2 per cent. of ash, could be converted into coke containing 7 per cent. of ash when only $1\frac{1}{2}$ parts of coal went to make one part of coke. He took great interest in the question of the introduction of coal into the locomotive engine, and he should hail any contri-

vance that would enable the locomotive to consume coal with the same amount of comfort to the public as they now had with coke.

Mr. Bethell thought he might have been misunderstood in his remarks in reference to the experiments on the relative heating powers of coal and coke. The point he desired to lay stress upon was, that he could not understand and he could not believe, that if proper apparatus had been used for burning the coke, the evaporative power would have been so small in comparison with that produced by coal.

Mr. Charles Greaves, on being called upon by the Chairman, said he did not feel himself to be well informed upon the bearing of this question as to locomotives, and the paper being specially applied to locomotives, it was only in reference to the burning of fuel in that manner that it was open to much criticism. For his own part, in comparing the efficiency of coal and coke in stationary boilers, and with every contrivance for husbanding the heat, he had found coke had produced greater efficiency than coal. He had tried every method for raising coal to the full efficiency of coke by weight, but he had not been able to do so by any process for the admission of atmospheric air. He had taken part in the discussion of Mr. Apsley Pellatt's previous paper about two years ago, and his further experience confirmed the opinion he then expressed, that the superiority of coke over coal by weight was from 12 to 14 per cent. In point of price, however, coke in London was 60 per cent. dearer than coal; there was, therefore, room for a considerable superiority in efficiency by weight of coke over coal, while still leaving a large economy in money in favor of the latter. There was one point about which he should like to hear a little more, that was as to the theory of the coke cutting the tubes of the boiler, for if that were the case what became of the coke? Did it go up the chimney and blow away as solid coke? This point had yet to be determined.

After some remarks from Mr. Duncan in reference to the analyses given in the paper,

Mr. Fothergill, in reply upon the discussion, said he had been entirely misapprehended by one or two gentlemen in reference to the analyses he had given. These analyses had been made in the laboratory of Mr. Dugald Campbell, and were not the result of actual experiment from the use of fuel in a locomotive engine. With regard to the statement of one or two of his friends that he had not brought the general subject fully before the meeting, he begged to state that these gentlemen had overlooked the object of this paper, which he had brought before the Society in fulfilment of a pledge he had given to communicate the results of experiments in which he was engaged as to the comparative merits of coal and coke as applied to the engine which was the invention of Mr. Beattie. That being the case, it would have been, he considered, quite out of place to have introduced more modern experiments, in order to confirm the results obtained at that period. With regard to the question of heating the feed-water referred to by Mr. Clarke in his letter, he would state that when experiments were first made with Mr. Beattie's engine that contrivance was not

appended to it. The apparatus then used did not enable them to feed the boiler with hot water at starting, but as they proceeded on the journey the temperature of the water became higher; but in the modern contrivance they could commence the journey with the feed-water at a high temperature. With regard to the relative quantities of the fuel, he had stated that $1\frac{1}{2}$ tons of coal had been used to produce 1 ton of coke; in some instances the quantity had been $1\frac{3}{4}$ tons of coal to produce 1 ton of coke; but, in order that there might be no misunderstanding upon that point, he had put the calculation into the money shape, and he had stated what the result was without taking into consideration how much coal it required to produce a ton of coke, but had at once given the cost of working the train, which he thought was the legitimate question to which they should turn their attention. He took the coal furnished at a given price, and also the coke, and then instituted a comparison between the two, not troubling himself about the different classes of coal and coke. He had conducted experiments for the Lancashire and Yorkshire, and the East Lancashire Railway Companies, but there was not time to apply the contrivance for heating the feed-water. With regard to the blast-pipe in Mr. Beattie's engines, they had to increase the amount of air to soften the blast, for if they had a powerful blast, they then got an over-heated smoke-box. He never knew an instance of that upon the South Western line but once, which was during a heavy wind, when they had a powerful blast, and the whole of the steam was used in passing up the chimney. The remainder of the questions discussed he believed had been satisfactorily answered in the paper itself, and he begged to thank the meeting for the attention with which they had listened to him.

The Chairman said they had heard a most interesting paper, and discussion upon it. After all that had been said on either side, they must come to the practical question—whether the use of coal or coke was the most economical, as well as the best mode of working a locomotive. He had not gathered that the accuracy of Mr. Fothergill's tables, in respect of the comparative economy of the two systems, had been impugned. Experiments with the engines at the same speed, and for the same distances, had been tried, and the result was as Mr. Fothergill had stated; and unless any one was prepared to impugn that statement, the case must be considered as so far made out. Mr. D. K. Clarke had made a most important statement. He had said that, supposing Mr. Fothergill's experiments to have been clearly made out, there would be a saving of 1 per cent. upon the aggregate railway dividends throughout the country, or no less than £300,000 per annum upon the railway capital of 300 millions. He thought the meeting was very much indebted to Mr. Fothergill for his simple, clear, and able statement of a very difficult and interesting question, and he hoped at some future period that gentleman would be induced to give them some further information upon the subject. He was sure the Society would unanimously pass a vote of thanks to Mr. Fothergill for his very interesting paper.

AMERICAN PATENTS.

List of American Patents which issued from July 12, to August 9, 1859, (inclusive,) with Exemplifications.

JULY 12.

102. Mode of Staying Piles for Wharves, Piers, &c.; E. H. Angamar, New Orleans, Louisiana.

Claim—In combination with the piles, the frames, the sleeves, and the braces, arranged as set forth.

103. Locks; S. T. Bacon, Boston, Massachusetts.

Claim—The construction of one or more pistons or drivers, or both; also, one or more holes in the rotating tumbler or surrounding cylinder, or both, as specified.

104. Bank and Safe Locks; S. T. Bacon, Boston, Massachusetts.

Claim—1st, Arresting and holding the tumbler in an exact locked position. 2d. Preventing the displacement of the tumbler in the direction of unlocking by means of pins, in combination with the sliding bottom key-hole guard and the tenons. 3d. Preventing the diaplacement of the tumbler at and beyond the locked position, by means of the slotted collar, in combination with the cylinder, the tumbler, and the tumbler pin. 4th, Preventing the displacement of the tumbler inwardly, by means of the collar, in combination with the cylinder and the bolt of the lock. 5th. Enlarging the piston holes throughout the lock. 6th, Enlarging the holes in both tumbler and cylinder, in each direction from the dividing line between them. 7th, Constructing the key-hole guard of two or more pieces of metal hardened. 8th, Making one or more chambers between the several parts of the key-hole guard. 9th, Dividing the air chamber or chambers with one or more narrow ridges.

105. Lamps; Joseph M. Batchelor, Foxcroft, Maine.

Claim—The arrangement and combination of an adjustable tube with the wick, button spindle, spur wheels, and friction spring, or the equivalents thereof.

[The stem of the button spindle has arranged on it in connexion with the small spur wheel usually employed for raising the wick, a larger spur wheel gearing into a rack projecting from the side of the wick tube, so that the wick and tube can both be raised or lowered by turning the bottom spindle in exact relative distances to produce the proper amount of light required.]

106. Devices for Training Pea Vines; John T. Bever, Haynesville, Missouri.

Claim—The posts, when forming a box, as described, and combined with cords, rope, and pegs.

107. Railroad Chairs; D. E. Bishop, City of New York.

Claim—The formation of a bridle in the centre of the continuous lift of a railroad chair, as described.

108. Grain Separators; J. L. Booth, Cuyahoga Falls, Ohio.

Claim—The box, provided with an inclined bottom or flooring and adjustable strips or valves, arranged to operate as set forth.

[This invention relates to an auxiliary device to be applied to grain separators that separate grain by projecting it against the air, and is more especially designed to be used in connexion with a grain separator that was patented by this inventor, March 8, 1859. In this machine the sound grain is separated from the light and inferior grain, in consequence of projecting it by certain mechanism forcibly against the air; the sound grain, by its superior gravity, being projected further than the light. The object of the present invention is to receive the grain, both the sound and light portions, as it is projected from the machine, and to more fully separate and to collect it into distinct parts, and to graduate the separation as may be required.]

109. Rat-traps; J. Borton, Middlebourne, Ohio.

Claim—The combination of the spring doors, rods, o o, dog, d, and rod, r, arranged in the manner set forth.

110. Combination of Flesh Fork and Skimmer; Charles B. Bristol, Nagatuck, Connecticut.

Claim—The combination of the fork and skimmer, constructed as described.

111. Mode of Operating Farm Gates; J. H. Butler and P. G. Van Houten, Cohocton, New York.

Claim—Actuating the traps by means of the weight and cord, arranged in combination with the lever, or its equivalent, for operating automatic gates, in the manner described. Also, the construction and operation of the double-acting latch, in combination with an automatic gate for carriages.

112. Walking Canes; Ansel Cain, Holyoke, Massachusetts.

Claim—The combination of the lamp, arranged in the manner described, with the walking cane.

113. Hanging the Bodies of Vehicles; J. H. Case, Lyons, New York.

Claim—The combination of the metallic springs with thorough braces, in the manner set forth. Also, the combination and arrangement of the combined thorough braces with the circular body and supplementary spring, as described.

114. Skirt Supporters; Matthew Chambers, City of New York.

Claim—Combining with and securing to a corset band extending in the rear, or in the rear and front downwards from the waist, to clasp the body around the hips of the wearer, the framework of a skirt or bustle, when said frame-work is composed of hoops disconnected and fastened in front, or thereabouts, as described.

115. Mode of Telegraphing from Railroad Cars while Moving; Denison Chesebro, Syracuse, New York.

Claim—The combination of a sufficient number of pendants, arranged as described, and each having a movable vertical tongue, and so constructed as to admit of a telegraph wire being attached to each of them in the particular manner specified, with the metallic plates, wood scantling, or equivalent, and conducting internal wires, attached to the roof of a railroad car.

116. Device for Fastening Cutters of Hollow Augers; Wm. A. Clark, Bethany, Connecticut.

Claim—The angle wedge, in combination with the cutters, face plate, screws, and ledges, as described.

117. FRUIT BASKET; David Cook, New Haven, Connecticut.

Claim—Making a metal bound wooden fruit basket, either plain or ornamental, when constructed and fitted for use, as described.

118. CONNECTING THE ENDS OF RAILWAY BARS; John Davis, New Bedford, Massachusetts.

Claim—1st, Connecting the rails of railroads in continuous chains with hinge joints, in any practical mode. 2d, Securing the rails in the couplings, by inserting wedges longitudinally under the rails, and clinching their margins. 3d, Wedge, D2, to secure wedge, D3, and vice versa, by means of the hinge joint or bolt.

119. WHEELS OF BUGGY BOATS; Perry Davis, Providence, Rhode Island.

Claim—Arranging paddles upon the spokes of the wheels of a buggy boat, so that the wheels perform the two-fold purpose of paddle-wheels and carriage wheels, in the manner set forth.

120. REVOLVING FIRE ARMS; W. C. Ellis and J. N. White, Springfield, Massachusetts.

Claim—The projection at the bottom of the chambers of the cylinders, on which the fulminate of the cartridge rests, and is struck by the hammer in the discharge. Also, the flanch of the cartridge parallel with the barrel, the two in combination, for the purpose specified.

121. APPARATUS FOR TANNING; L. C. England, Oswego, New York.

Claim—In combination with the leach-vat and the conveyer trough, the pair of rollers to crack the wet bark before it is delivered into the leach vat.

122. FIREMAN'S LADDER; Daniel Fitzgerald, City of New York.

Claim—1st, Suspending a ladder upon a standard, so that it may be elevated and turned in any direction. 2d, The arrangement of the branch pipes with the stop-cocks for use at various heights. 3d, Making the main pipe serve as a hand-rail to the ladder, and to give it stiffness, by setting it up a little above and parallel to it, as described.

123. METHOD OF HANGING PICTURES, LOOKING-GLASSES, &c.; W. A. Foster, Chester, Connecticut.

Claim—Adjusting picture frames or mirrors to different positions and at different angles, by means of a central hinge and levers, as described.

124. BREECH-LOADING FIRE ARMS; M. J. Gallagher and Wm. H. Gladding, Savannah, Georgia.

Claim—Forming the chamber in the barrel and breech of the gun of the shape of two frustrums of cones, or of a frustrum of a cone, and a section of a parabolic spindle, whose bases meet at or near the line of the joint between said barrel and breech, for the purpose of containing a cartridge case of the form as represented.

125. CLOTHES FRAME; Joseph Gasser, Toledo, Ohio.

Claim—The arrangement of the braces and arms in connexion with the standard and legs, as set forth.

126. DUMPING CAR; David Glover, Cass Township, Pennsylvania.

Claim—The construction of a revolving tip placed upon a movable frame or truck, the side pieces of which form, at a certain stage of the operation, a continuation of the main track or foundation, by means of which the wagon or car can be taken, without handling, from the main track or foundation, with the load moved to the place required, and there dumped in any direction.

127. SHINGLE MACHINE; Freeman Godfrey, Grand Rapids, Michigan.

Claim—The cams, gearing into rack bars attached one to each end of the carriage, said cams being fitted in a yielding or adjustable centre-poised frame, and operated from the power lever, through the medium of the pawl, ratchet, and gearing.

128. MACHINE FOR MAKING PAPER BAGS; Wm. Goodale, Clinton, Massachusetts.

Claim—1st, Making the cutter which cuts the paper from the roll or piece of the form herein described, that, in cutting off the paper, it also cuts it to the required form to fold into a bag without further cutting out. 2d, The attachment of the former directly to the cutter to operate in combination therewith, and with a folding table. 3d, The described mode of applying and arranging the paster, to operate in combination with the folding table and the former. 4th, The construction of the side lappers with angular ends, for the purpose of partly folding the sides of the bag. 5th, The knock-off, operating in combination with the former. 6th, The vibrating frame with its rollers, operating in combination with the former and the knock-off, as described. 7th, The arrangement of the table, the cutter, the former, the side lappers, the bottom paster, the knock-off, and the vibrating frame, to operate in relation to and in combination with each other.

129. MACHINE FOR SPLITTING FIRE-WOOD; Darwin A. Green, City of New York, Administrator of Elias Davis, deceased.

Claim—The slabbing knife and splitting knives secured to one cross-head, acting simultaneously at the forward movement of the latter, as described.

130. DRY GAS METRES; Tobias Grodjinski, City of New York.

Claim—Attaching each pair of the plates, or their equivalents, to the flexible part of the diaphragms of dry gas metres, by overlapping parts of the one upon the other, in the manner set forth.

131. SEWING MACHINES; George Hensel, City of New York.

Claim—The construction of the disc with an elastic plate attached, and operated by means of a cam, in the manner set forth.

132. STOVES; S. Emilius Hewes, Albany, New York.

Claim—A revolving fire-pot, arranged to traverse perpendicularly or to be raised and lowered, as described, for the purpose of supplying air to, and shutting it from, the openings in the sides of the fire-pot, so as to effect a ready and perfect combustion and consumption of the fuel.

133. CLOTHES FRAME; H. J. Holmes, Warren, Massachusetts.

Claim—A series of vertical frames, one of which has permanently affixed to it a foot-piece and cap, when said cap and foot piece forms suitable bearings for other frames, arranged as set forth.

134. WATER-WHEELS; John P. Hughes, Spout Spring, Virginia.

Claim—Making the water arms in sections, essentially as described.

135. DUMPING WAGON; Anthony Iske, Lancaster, Pennsylvania.

Claim—The drop-door with its lever, the partitioned box with its rack bar on the bottom, the handled spindle for moving the same, as specified.

136. Machines fot Dressing Mill-stones; John W. Kennedy and John F. Plummer, Plainfield, Connecticut.

Claim—The arrangement and combination of the arbor, forked arm, spring, shaft, U, ratchet and pawl, wiper, bar, movable case, shaft, K, and adjustable plate, as described.

137. Head-block for Saw-mills; J. Kurtzeman, Lancaster, Pennsylvania.

Claim—The sliding rack bar placed longitudinally in the carriage, and adjusted therein by the wedges in connexion with the gearing, whereby the two sides may, by a suitable adjustment of the wedges, be actuated both simultaneously and separately, as may be desired.

138. Method of Constructing Mallets; Wm. Lance, Olney, Illinois.

Claim—The manner of their construction and arrangement, as described.

139. Bee-hives; John K. Leedy, Woodstock, Virginia.

Claim—1st, The boxes, constructed and arranged in the manner specified. 2d, In combination with the boxes, the pipes, and their faucets, all arranged in the manner set forth.

140. Salimometer; Robert H. Long, Philadelphia, Pennsylvania.

Claim—The means of drawing into a vessel water from a steam boiler as a means to facilitate testing the density of the water in the same, constructed and arranged as set forth.

141. Life-preserving Raft; A. G. Mack, Rochester, New York.

Claim—Surrounding a cask or chamber with conical floats arranged radially with said chamber and hinged thereto, and covering the cone with canvass, or other suitable material, and bracing the whole together by a rope, suitably arranged.

142. Paint Cans, &c.; John Masury, Brooklyn, New York.

Claim—The construction of a metallic can for hermetically sealing paints and other substances, having attached thereto a rim or ring of thin brass, or other soft metal, in such a manner that the top or cover may be removed by severing the said rim or ring of brass, or other soft metal, with a penknife or other sharp instrument, in the manner described.

143. Earth-boring Augers; A. A. McMahen, Oxford, Mississippi.

Claim—Bracing the two ends of the spiral portion of the auger by means of the central rod, in the manner described. Also, the manner of securing the boring tools and rod to the spiral, by which they may be removed and replaced without making any changes on the spiral, in the manner described.

144. Dredging Machine; Anton Menge, Point a la Hache, Louisiana.

Claim—1st, The bucket frame, when resting upon adjustable casters or friction rollers, and operated so as to be swung from right to left of the boat upon a circular track, in combination with the oscillating shaft, all arranged in the manner set forth. 2d, The buckets having a hinged back, arranged as specified.

145. Preserve Cans; F. O. More, Bellefontaine, Ohio.

Claim—The peculiarly formed cap, in combination with the curved spring lip.

146. Portable Oven; Z. N. Morrel, Cameron, Texas.

Claim—Forming the pin on the handle on the cover of a Dutch oven or skillet, in combination with the tube under the centre of the frying-pan or gridiron.

147. Dynamometer; Charles Neer, Albany, New York.

Claim—The combination of the rigid arm or arms and yielding incline or inclines with the loose pulley, or its equivalent, whereby the power exerted to rotate the shaft is denoted by the motion resulting from the pressure against said yielding incline or inclines, for the purpose of forming a rotary dynamometer. Also, the revolving and sliding cone adjusted in its position according to the power applied from the pulley to the shaft, when combined with a registering apparatus to record the amount of power made use of.

148. Washing Machine; Charity Pendleton, Galena, Illinois.

Claim—1st, The combination of the two horizontal bars or rails, J and M, having a circular reciprocating motion, with the fixed corrugated cylinder surface forming the bottom of the machine, and having its axis coincident with the axis of motion of the said bars, the parts being constructed and arranged as described. 2d, The combination of the slot or mouth in the arm, and the tenon at the ends of the corrugated rubbing bar, M, with the perforated bar, J, by which the portion of the said corrugated rubbing bar, M, may be altered with respect to the bottom of the machine, so as to increase or diminish its distance therefrom, and without altering the position of the bar, J. 3d, The combination of the corrugations on the lower surface of the rubbing bar, M, with similar corrugations on the bottom or concave of the machine, but so arranged that the direction of the two sets of corrugations will be at right angles to each other.

149. Method of Operating Windlasses when Applied to Hay-presses, &c.; Peter Philip, Ghent, New York.

Claim—1st, Attaching the wheel or table to the capstan, so as to be operated upon by the loose or boom-sweep as a brake, for the purpose of stopping the press at any point of descent, while being filled, and of regulating and controlling the motion of the capstan in the uncoil. 2d, Providing the capstan with the arms and the loose or boom-sweep, in combination with the check lever, in the manner and for the purpose set forth.

150. Machine for Boring Hubs; Daniel Quimby, Littleton, New Hampshire.

Claim—The shaft, the boss placed on said shaft and provided with a conical bore, and having the collar and arms attached, the screw rod connected with the collar by the gearing, and providing with the divided nut attached to the upright, arranged as set forth. Also, in combination with the parts above named, the convex projection placed on the shaft, to operate as specified.

151. Pocket Register of Count; P. D. Richards and F. N. Thayer, New Orleans, Louisiana.

Claim—The construction and arrangement of a hand-operating talley, consisting of three indexes and corresponding wheels to indicate count, as specified, the whole being operated by a projecting stud and spring brake with its gauge.

152. Pen and Pencil Cases; John Richardson, City of New York.

Claim—The arrangement of the spiral grooved sleeves and their connexion with the pen-holder and pencil, and also with the outer shell of the case, as described.

153. Hydrostatic Lifting Jack; John Robertson, Brooklyn, New York.

Claim—The employment of the exterior movable hydraulic cylinder with toe-piece upon its surface, in combination with the standard, which serves also as piston and eduction pipe, as described.

154. SELF-DETACHING WHIFFLE-TREES; Wm. G. Russell, Winchester, Virginia.

Claim—A swingle or whiffle-tree provided with a lever turn bar, together with the spring clasp and the hinged or jointed hooking ferules, arranged as set forth.

155. COAL SIEVES; Silas T. Savage, Albany, New York.

Claim—The employment of the two half-globes, in which there are interstices, as a coal sifter, when said half-globes are provided with grooves, tongues, and shoulders, the same being used in connexion with a box or cylinder, by means of which the two portions of the globe are prevented from moving endwise of the trunnions and are prevented from separating.

156. SAWING MACHINE; T. W. Schmidt, Philadelphia, Pennsylvania.

Claim—The combined arrangement of the stationary frame fitted with the adjustable holders and the saw carriage operated by the crank, shaft, f', spur wheels, shaft, m, and rope or chain, whilst the saw is at the same time rotated through the media of the gear-wheel, pulley, and band, the said stationary frame and the said moving saw carriage, operating together as described.

157. MACHINE FOR MAKING HAND-RAILS FOR STAIRS; Cornelius R. Shaeffer, Gettysburgh, Pennsylvania.

Claim—The combination of the perpendicular square post erected upon the base with the draft-board, pitch-boards, rod, and arm, arranged as set forth.

158. CONFECTIONERY SAFE; Reuben Shaler, New Haven, Connecticut.

Claim—The confectionery safe, constructed substantially as specified.

159. CORN HUSKERS; George F. Shaw, Woburn, Massachusetts.

Claim—The combination and arrangement of the cylinder and concave roller, as described.

160. REFINING IRON; Christian Shunk, Canton, Ohio.

Claim—The use of the external crucible or hearth having the tweer pipe, the projecting stone, and the escape pipe, operating in such a manner that the blast shall deflect from the side of the upright stone and produce a rotary movement in the melted metal for the purpose of refining the same, as specified.

161. THRESHING MACHINES; Joseph Siddall, Philadelphia, Pennsylvania.

Claim—The combination of flails, roller, slides, and straps, when said flails are constructed with the flexible joints, the arrangement and operation being as set forth.

162. LOCK FOR FIRE ARMS; Michael Troouly, Mount Vernon, Indiana.

Claim—1st, The combination of the hooks, or their equivalents, respectively formed on the claw of the link and the trigger, as described. 2d, Widening the upper end of the trigger so as to form a projection in front, whose lower curved edge shall operate on the curved surface of the claw, in the manner set forth.

163. ARTIFICIAL STONE; J. L. G. Ward, Adrian, Michigan.

Claim—A cement composed of pumice-stone, silicate of soda, fluor spar, and Roman cement, as set forth.

164. PRESERVE CANS; Oliver N. Weaver, Dover, Kentucky.

Claim—The perforated elastic plug secured in the top of a provision can, with a nozzle and tube communicating with an exhausting chamber, as set forth.

165. TRAP FOR ANIMALS; Loren Wetmore, Tioga County, Pennsylvania.

Claim—1st, The peculiar construction and arrangement of the manifold trap, as set forth. 2d, The arrangement of the trip provided with a fulcrum or fulcra, guide pin, and arched wire, for operating the trap, as set forth.

166. ATTACHING THE HEADS OF METALLIC POWDER-KEGS, &c.; James Wilson, Charles Green, and Wm. Wilson, Jr., Wilmington, Delaware.

Claim—The double seaming of both heads of the keg and the opening in one head, in the manner described.

167. HOLLOW AUGER; Arcalous Wyckoff, Elmira, New York.

Claim—Combining the transverse auxiliary cutters with the prime cutters and elliptic opening of the annular cutter head, as described.

168. BREECH-LOADING FIRE ARMS; Peter Altmair, Assignor to self and Myron M. Faxon, Lewiston, Penna.

Claim—In combination with a fixed breech-piece, a hinged barrel, so arranged as that the said barrel shall swing upward and expose the chamber of the breech-piece, below the rear end of the barrel, for inserting the charge, as described.

169. MONEY-DRAWER ALARM; R. M. Campbell, East Cambridge, Assignor to self and Benjamin S. Wright, Boston, Massachusetts.

Claim—The combination and arrangement of the two levers and the spring latch with the clock-alarm apparatus, the striker, and bell, and the combination of the same and a series of perforated key slides and a set of T-bars applied together and to such levers so as to actuate the same. Also, the combination and arrangement of the T-bars and the perforated key slides, to operate in manner described. Also, in combination with the key-lock and the T-bar, I, a latching apparatus placed in the case, and constructed so as to lock both the cover and the T-bar, or either, as specified. Also, the combination of the detector or indicator with the case cover and the T-bar, H, and operated in manner specified.

170. SAFETY APPARATUS FOR CITY RAILROAD CARS; Samuel Green, Lambertsville, New Jersey, Assignor to self and W. R. Green, Philadelphia, Pennsylvania.

Claim—The swinging frame in connexion with the bolt and the cover, the brake blocks in connexion with the chains and rods, and the stationary supporting piece, or their equivalents, arranged in the manner described.

171. CLASPS FOR SKIRT HOOPS; Samuel B. Guernsey, Waterbury, Connecticut, Assignor to W. H. Reed and G. W. Zeigler, City of New York.

Claim—Connecting the hoops with the straps, or equivalents thereof, for connecting and suspending them by means of plates bent to embrace the hoops, and formed with two slots or apertures, through which the straps, or equivalents, pass, thus clasping the straps, or equivalents, to the hoops, as described. Also, the employment of the metal clasps, constructed as above described, in combination with and as a means of connecting the ends of the hoops, as described.

172. CATTLE GATES FOR RAILROADS; Moses Hall, Jr., Assignor to self and S. H. Judy, Osborn, Ohio.

Claim—Constructing a cable guard or gate with its cross-bar or shaft below the rail of the railroad track, and operated by springs, as described.

173. APPARATUS FOR PACKING FRUIT; Robert Law, Lockport, Assignor to self and P. T. Dix, Olcott, N. Y.

Claim—The V-shaped or wedge-acting yoke provided with fulcrum pins, and the hooked recesses in the upper ends of the bent clamping levers arranged and acting in combination with the screw, fulcrum link, and claws, or their equivalents, in the manner specified.

174. SEWING MACHINES; Sidney Parker, Assignor to self and Hugh Herringshaw, City of New York.

Claim—The combination of the hook and the feeding arc, in the manner set forth. Also, the method of adjusting the feed, by means of the combination of the spring piece and the feeding arc, in the manner described.

175. SUGAR MILLS; John Paynter, Assignor to self and John McCorkle, Shelbyville, Indiana.

Claim—The combination and arrangement of the journal, wheel, gearing, and rollers, the whole being suspended in a frame, and constructed as described.

176. WINDING SKEINS OF THREAD; Asa T. Ring, Newton, Assignor to N. T. Spear, Boston, and A. J. Robinson, Milton, Massachusetts.

Claim—The combination of the clamping spring, screw, and guide pin or rod, with the tightening and supporting shank and bobbin, arranged as specified.

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177. WASHING MACHINE; Lewis Allen, Sleepy Creek, Virginia.

Claim—The construction of the open hollow washing, rinsing, and dipping cylinder, composed of a series of bars placed at regular intervals from each other, and provided with an open net-work. Also, in combination therewith, the fluted or ridged pressure, squeezing cylinder, and detachable framing, arranged in the manner described.

178. VARIABLE EXHAUST DEVICE FOR STEAM ENGINES; Jacob Barney, Chicago, Illinois.

Claim—1st. The employment of two cylinders so provided with gradually tapering grooves in each, that when revolved together, an expanding and contracting circular opening will be formed for the purpose of regulating the passage of the exhaust steam from locomotive and other engines. 2d. The cylinder, as constructed, when used in combination, the tight metallic case and packing, arranged in the manner set forth.

179. UNIVERSAL JOINTS; James Baylor, Canton, Illinois.

Claim—Connecting shafts, when placed angularly with each other, by means of the universal joints, constructed as described, by which a rotary motion may be transmitted from one shaft to the other.

[This invention consists in the employment of a cylindrical coupling box, having two slotted bars pivoted within and at either end of the box, at right angles to each other, to the centres of which the ends of the shafts are pivoted, so that a rotary motion can be conveyed from one shaft to the other when they have a considerable inclination, thereby dispensing with the beveled wheels commonly employed for this purpose, and obtaining a regularity of motion with very little friction.]

180. BOOT-TREES; W. H. Bettes and I. H. Parker, Kokomo, Indiana.

Claim—1st. The employment of the sleeve in connexion with the screw shaft, the two being arranged as set forth. 2d. The arrangement of the cords with the levers, in the manner set forth. 3d. The combination of the instep, side-pieces, and toe-piece, when so arranged that they will operate simultaneously, as described.

181. BEDSTEAD CORD-PIN; J. T. Bever, Mainesville, Missouri.

Claim—A bedstead cord-pin, consisting of two parts, which are constructed and operated in the manner described.

[The invention consists in forming an eye through the ordinary pin, and having a turning-piece pass through said eye. This piece has a square head to receive a wrench; it also has ratchet teeth formed on it to gear with reverse set ratchet teeth formed in the side of the pin. The bed cord attaches to the inner end of the turning-piece, and consequently when said piece is turned, the cord is twisted and made tight; the ratchet teeth preventing any slipping after the desired tension on the cord is produced.]

182. SUGAR-CANE PRESSES; Wm. Bull, New California, Wisconsin.

Claim—The arrangement and combination of the hinged adjustable frame, E, roller, J, frame, A, wedge, inclined spouts, and roller, D, as described.

183. COTTON GIN SHARPENER; A. H. Burdine, Chulahoma, Mississippi.

Claim—1st, The combination of two-crossed reciprocating files with a circular feeding disc, which is constructed with an angular recess and an inclined hook at one point of its circumference. 2d, The combination of the above with a jointed slotted frame and a driving cam.

184. STOVES; P. N. Burke, Buffalo, New York.

Claim—The arrangement and combination of the perforated plates, the partition plate, the flue, the fire-guard, hot air-pipe, and chamber.

185. MACHINES FOR PLANING METAL; Jeremiah Carhart, City of New York.

Claim—1st. The pressure plate or plates, in combination with the reciprocating bed and feeding strip, when said plates extend substantially the length of the blank to be planed, and the bed travels far enough to carry the feeding end of the strip entirely past the facing cutter at each operation. 2d, Rebating the inner edges of the pressure plate or plates in such manner as to furnish at once edge guides and pressure for the blank while being fed to the cutters. 3d, In combination with the pressure plates and cutters, the shields extending downwards from the pressure plates to protect the space between the plates from shavings and other foreign matter. 4th, In combination with the reciprocating bed and feeder, the scraper and brush, acting in combination for cleaning the bed and feeder or feeding strip.

186. HARVESTERS; Herman Carter, Greene, New York.

Claim—The vibrating discharger, in combination with the rake, arranged in the manner described.

187. CANAL-BOAT PROPELLER; Robert Cartwright, Ithaca, New York.

Claim—The step or bearing block, arranged relatively to the rudder and vessel to receive the end thrust

of the propeller shaft, and thus relieving the gearing and rudder from pressure, the whole end thrust of the propeller being upon the step-block, which is arranged to admit of any lateral motion to the vessel's centre line, thus forming a steering as well as propelling power, and being all placed externally, it entirely obviates the necessity of entering the vessel below the water line.

188. Coffee-pots; William Chesterman, Centralia, Iowa.

Claim—The arrangement and combination of the piston-packed strainer, cylinder, receiving vessel, socket, and condenser, as described.

[By the peculiar arrangement of this coffee-pot, when the water in it is heated, the steam presses up through the strainer containing the ground coffee, and through a quantity of water above the strainer, so that when the pot is taken off the fire, a vacuum is formed in the lower portion of the pot, and the water above the strainer is forced through the ground coffee into the lower portion of the pot, whence it is drawn off by a spout, and the upper portion of the pot is provided with an air-tight vessel, which acts as a condenser for the vapor of the uppermost water, so that no aroma escapes.]

189. Vegetable Cutter; John Clary, Dayton, Ohio.

Claim—The arrangement of the cutting disc suspended from the cross-piece in connexion with the convex cutting edge of the cutters, in the manner set forth.

190. Double-acting Pumps; William H. Davis, Austin, Indiana.

Claim—The construction and arrangement of the air chamber, side pipe, and cylinders, and flanch at the top, all in one piece of casting, for the purpose of suspending the cylinders sufficiently deep in the well to prevent freezing, in combination with the bottom plate.

191. Stoves; Rufus Dawes and W. C. Choate, Washington City, D. C.

Claim—The combination of a new fire-room for a downward draft, having a lid to close the opening at the top, containing a valve in the lid and an open grate in front, having a door to close this opening air-tight, with a system of ovens heated and ventilated.

192. Rotary Cultivators; B. F. Field, Sheboygan Falls, Wisconsin.

Claim—The combination of two or more wheels on one crank eccentric, or equivalent axle, when the said wheels are arranged in pairs on the axle, one wheel within the other, and so as that the spades or forks attached to the inner wheels shall pass out and in through the apertures in the outer wheels, for the purpose of displacing and pulverizing the soil over which they pass, in the manner described.

193. Stoves; J. D. Field, Davenport, Iowa.

Claim—The fire-chambers, D I, flue, and water heater, the latter being provided with inclined tubes to form the grate of the fire-chamber, D, the above parts being arranged relatively with each other, the oven, and the smoke-pipe, to operate as set forth.

194. Variable Cut-off Gear with Steam Engines; Ambrose Foster and Noah Sutton, City of New York.

Claim—The employment for operating either the main valve or valves of an engine or a separate cut-off valve or valves, of a compound cam, composed of two parts, C and D, constructed and combined with each other and applied to the main or a counter shaft, as described.

195. Lock for Safes, &c.; August Freutel, City of New York.

Claim—1st, The slotted wheels, m, on the tumbler, l, and the plates, in combination with the wheels, 6, of the knobs, when said wheels, m, are so arranged that the act of unlocking, or attempting to unlock, the bolt moves the wheels, m, away from the wheels, 6, in the manner specified. 2d, In combination with the tumbler, l, carrying the wheels, m, and acting as aforesaid, I claim the cross-piece and tumbler, as set forth.

196. Harvesters; C. B. and G. B. Garlinghouse, Allensville, Indiana.

Claim—The peculiar arrangement of the disc in relation to the mechanism for operating the cutters, the standard, and sliding frame, in the manner specified.

197. Trimmer for Lamp Wicks; Halvor Halvorson, Cambridge, Massachusetts.

Claim—In combination with a knife and bed or anvil, or other suitable wick-cutting devices, gauges, arranged as shown, or in such a manner as to hold or retain the wick, and prevent it expanding laterally, while under the action of the cutting device.

198. Lathes; Jacob Hess, Niagara Falls, New York.

Claim—The combination of the grooved central shaft with its movable discs, adjusting gears, and index spring hook, all arranged in relation to each other, as set forth.

199. Machines for Raking and Loading Hay; Grove Howard, Westfield Township, Ohio.

Claim—The arrangement of the endless belt, pulleys, curved teeth, rods, lever, and catch in the frame, and with the body, constructed and operating as specified.

200. Bit-stock and Wrench; L. S. Hoyt and B. B. Beers, New Fairfield, Connecticut.

Claim—1st, The wimble or bit-stock wrench with one permanent and one movable jaw, which may be readily adjusted to turn nuts or screws of different sizes. 2d, The block, or its equivalent, with a socket adapted to receive and hold the shanks of common bits and fitted to the permanent or movable jaw, or both, so as to hold the block and bits. 3d, The screw, so arranged as to fasten the block on to the jaw and the bit in the socket at the same time.

201. Steam Cock; Wm. Johnson and Martin Silmser, Auburn, New York.

Claim—A plug cock, with a sectional plug, whose sides are inclined to its axis, in combination with a single casing through which and directly opposite are openings whose sides are parallel to the axis of the plug, and constructed as described.

202. Joint for Pump-pipes; David Knowlton, Camden, Maine.

Claim—Making the joint hemispherical, in combination with the stiff or rigid flanches, by which the parts joined hemispherically may be held at the desired angle.

203. Ships' Warping Chock; David Knowlton, Camden, Maine.

Claim—The cast iron warping chock described.

204. Hose Coupling; A. H. Lowell, Manchester, New Hampshire.

Claim—The locking devices described, in combination with the screw tube, arranged in connexion with, and on the outside of said locking devices.

205. Grain Separators; Franklin I. May, Beverly, New Jersey.

Claim—1st, The two side or supplementary inclined planes, in combination with the short inclined plane and the two adjustable guides, arranged together so as to operate as described. 2d, The employment of the sliding board in the shaker, when the said board is arranged to operate in combination with the screens therein, for the purpose of better preparing the grain, &c., for the inclined planes and the rotary screen.

206. Foot-stoves; James H. Maydole, Eaton, New York.

Claim—In combination with a foot-stove, the several parts thereof being arranged in the order specified, the employment of a lamp constructed with an intermediate space filled with plaster of Paris, or the equivalent thereof, whereby I am enabled to prevent the heating of fluid contained therein.

207. Machine for Turning Skins; Isaac C. Mayer, Jersey City, New Jersey.

Claim—The implement, constructed and operated as herein described, for the purpose of turning the skins used by furriers.

208. Furnace Grates; E. I. McCarthy, Saugerties, New York.

Claim—A furnace with a series of stationary grate bars, in combination with a series of movable blades, so arranged as to pass between and above the bars, and descend below so far as not to obstruct the draft and be beyond the influence of the intense heat of the furnace.

209. Excavating and Grading Machine; Z. N. Morrel, Cameron, Texas.

Claim—1st, The employment of a revolving cylinder of blades, arranged at the lower end of the inclined digger, in combination with said digger, and with a series of coulter ploughs, arranged at the front end of the machine. 2d, The employment of a revolving cylinder of teeth or blades, arranged at the upper end of the inclined digger, in combination with said digger.

[By this invention the soil is first cut up in long narrow slices, then divided transversely into small clods, next elevated and pulverized, and then conveyed by endless longitudinal apron conveyers, which discharge it at right angles to or on one side of the grade or ditch.]

210. Machine for Scouring and Polishing Coffee; William Newell, Philadelphia, Pennsylvania.

Claim—The combination of the two cylinders, having a space between them, with the scarified arms or beaters moving in contrary directions.

211. Railroad Car Brakes; William Perkins, Plympton, Massachusetts.

Claim—1st, The arrangement of the sliding buffers, brake levers, rod, i, hooked rods, b b′, and staple, to operate in combination with the brake. 2d, Arranging the brake shoes, in combination with the staple and hooks, m m′. 3d, The arrangement and combination of the hooked rods, l l′, and the rods, o o′, and with the staple, so that the hooks, m m′, can be adjusted according to the direction in which the car is to run. 4th, The arrangement and combination of the sliding buffer, lever, and spring, as specified.

212. Mode of Heating Drying Cylinders by Steam; A. P. Pitkin, Hartford, Connecticut.

Claim—In combination, the closed heating cylinders, force pump, vacuum valve, and connecting tubes, in the manner set forth.

213. Saw Gummer; William Porter, Mexico, New York.

Claim—1st, The arrangement and combination of the lever with the sliding box by means of the bar, m, so as to give a continued and downward action upon the cutter or burr by the use of the coiled springs, thereby feeding the said cutter or burr. 2d, The arrangement and combination of the index pointers, with the index and the bars, t t′, connected to the frame, so as to give any required direction to the cutter or burr. 3d, The use of the set-screw by means of which the distance between the blocks is adjusted proportionally to saw plates of different thicknesses prior to being fastened thereto by the eccentric lever.

214. Oscillating Steam Engines; John A. Reed, Jersey City, New Jersey.

Claim—The arrangement of the reversing valve in a steam chest on the top of a bridge-piece, in combination with the separate passages in the bridge-piece communicating the chambers in the trunnion boxes.

215. Apparatus for Working Pumps; Benjamin Robbins, Machias, Maine.

Claim—The combination and arrangement of the crank, fly-wheel, lever, walking beam, and piston rods, as set forth.

216. Furnace for Dental Purposes; Edward A. L. Robbins, City of New York.

Claim—The arrangement and application of the double inclined grates, as set forth. Also, in combination with such inclined grates, the parts to contain the muffle, retort, &c., as set forth.

217. Hay Press; Charles Rundlett, Alden, and John W. Drummond, Winslow, Maine.

Claim—The arrangement of the driving drum or windlass and driving gear with reference to the press-box and the platen screws and their pinions, disposed on the sides of the press-box. Also, the combination and arrangement of the connecting rods and rings with each platen-elevating screw, and the bars of the cover of the press-box, the whole being to operate as specified. Also, the mode of applying the draft-rope guide to the press frame and the driving pulley, that is, by means of a fulcrum, and the screw or projection made to enter the helical groove of the driving pulley.

218. Edge Planes; Henry Sauerbier, Newark, New Jersey.

Claim—The bevel wheel, e, pinion, worm, wheel, o, socket shaft, pinion, feed wheel, cutter head, ganges, roller, lever piece, and corliss head, arranged as specified.

219. Hydraulic Motor; Morrill A. Shepard, Orin, Illinois.

Claim—The combination of the vacuum tube, e, and tube, c, for giving motion to the water-wheel by the action of an undammed stream, as described.

220. Metallic Bung; T. Briggs Smith, Marietta, Ohio.

Claim—A metallic screw bung for casks, or other wooden vessels, for holding liquids, with a knife-like thread, and an elevation at any point between the threads, and a shoulder on the bung let into the stave.

221. Furnaces; Lewis Solomon, City of New York.

Claim—So constructing a desulphurizing furnace for roasting the ores of precious metals, as that the heat shall be applied first beneath the sole of the furnace and afterwards on the surface of the ore, when the same is combined with a chamber arranged in the base of the chimney for the reception of such volatilized particles of ore, &c., as may be driven off by heat or carried over by the draft.

222. Snow Ploughs; M. B. Spafford, Warsaw, New York.

Claim—The vertical rotary shaft with its spiral wings for the removal of snow from the railroad track, as described.

223. Lasts; Obed S. Squire, New Haven, Connecticut.

Claim—The arrangement and combination of the longitudinal sections, strips, and bolt, as described.

[By this improvement the manufacture of india rubber boots and shoes is much facilitated, the lasts being made in two halves, so that the shoe or boot can be widened without the length being increased and varieties of shape obtained without the necessity of tabs upon the last.]

224. Meat-masher; George Storer, New Britain, Connecticut.

Claim—The hollow or solid cylinders with pointed angular teeth, the base of which teeth has nearly in contact, and in combination therewith, the device for adjusting the cylinders, as specified.

225. Stoves; John G. Treadwell, Albany, New York.

Claim—The combination of the division, c, with the damper and doors, arranged in the manner specified.

226. Stoves; John G. Treadwell, Albany, New York.

Claim—The employment of hinged plate, in combination with the hearth-plate above, the two being used in the manner specified.

227. Elbow for Stove Pipes; A. K. Tupper, Clarkson, Michigan.

Claim—Constructing the joint of pipes with flanch, f', and the overlapping flanch, f', so as to allow the pipe to be adjusted at any desired angle.

228. Machine for Cutting Heels and Soles for Boots and Shoes; Albert Warren, Jefferson, Ohio.

Claim—The bent knife, Y, resting on the shoulders of the movable slides, as described. Also, the knife, Y, resting on the shoulders, in combination with the knife, Q, adjusted as set forth, and by which any size or shape of leather may be cut, ready to be sewed or pegged upon the boot or shoe.

229. Harvesters; W. A. Wood and J. M. Rosebrooks, Hoosick Falls, New York.

Claim—In combination with a main frame supported upon two driving wheels, and which frame carries the shaft and main cog-wheel, a second frame, hinged to said shaft, so that the crank shaft on said second frame shall always be in a radial line to the main cog-wheel, however much said second frame may vibrate on the main frame.

230. Fastening for Bedstead Drapery; George W. Watrous, Hartford, Connecticut.

Claim—A drapery fastening, constructed of a case, hook, and link, as described.

231. Pumping Engine; Henry R. Worthington, Brooklyn, New York.

Claim—1st, The combination set forth and exhibited of two direct-acting pumping engines, propelled by steam or other fluid, so arranged as that each engine shall actuate the inlet and outlet valves, governing the motive power of the other, thereby ensuring the constant action of at least one pump piston upon the water, and relieving the action of the pump from shocks and concussions. 2d, The arrangement shown of two distinct systems of levers adapted to the steam and exhaust valves of each engine, the one system to be operated upon for producing motion and for determining the duration of the repose of the piston at the termination of the stroke, the other for bringing the pistons to a state of rest.

232. Railroad Switches; Jacob Beachler, Assignor to self and J. F. Brickley, Anderson, Indiana.

Claim—The obstruction or "scotch" applied to the turn-out and connected with the switch so as to be operated automatically by the movement of the same.

233. Elbows for Stove Pipes; Norman Bedell, Assignor to S. P. Bedell, Albion, New York.

Claim—1st, The employment of the metallic frame, constructed in the manner set forth. 2d, The combination of the clasp with the frame, as constructed, for the purpose of holding the miter edges of the pipe together.

234. Machine for Polishing Corks; H. F. Cox, Jersey City, New Jersey, and Alex. Miller, City of New York, Assignors to H. F. Cox, aforesaid.

Claim—The cork-polishing machine, consisting of a series of rollers roughened by a surface of pumice-stone, or equivalent abrading material, and a brush or brushes acting in conjunction to polish the cylindrical portion of machine-made corks.

235. Dies for Shaping Articles in Metal; Levi Dodge, Assignor to self and Dodge & Blake, Waterford, New York.

Claim—The forming of articles of iron, or other metal, when such articles are to be shaped by a simultaneous action or pressure of dies on several or all sides, the employment of the movable dies, operating substantially upon the principles set forth.

236. Corn Huskers; Moses H. Gragg, Assignor to self and T. N. Page, South Boston, Massachusetts.

Claim—The arrangement and combination of the small intermediate conical roller, larger conical rollers, guard, and hopper, as described.

237. Stoves; Joseph C. Henderson, Assignor to Rathbone & Co., Albany, New York.

Claim—1st, The air-space between the oven and the fire, when so arranged that a descending draft the whole width of the stove passes through said space, and thence to the fire, for promoting combustion, and at the same time rendering the temperature of the oven more uniform. 2d, The damper at the front end of the oven, in connexion with the descending flue between the front plate and fire-box, whereby the oven can be entirely closed when the stove is in use for roasting.

238. Churn; Lorenzo Lake, Assignor to self and Wm. Patton, Middlebury, Pennsylvania.

Claim—The dasher, made in the manner as described, when the same shall be operated by the devices, as described.

239. Journal-boxes for Railroad Cars; Robert McWilliams, Assignor to S. H. Hoffman, Philadelphia, Pa.

Claim—1st, The upper half of the box with its socket formed by the flanches, in combination with the lower half of the box, when the two halves are arranged so that on adjusting the lower half to its place it may assume the position shown in fig. 1, and so that when adjusted the end of the oil chamber shall be close to the axle. 2d, The self-adjusting leather packing and the metal plate, when both are dependent upon the

lower half of the box for their proper position within the other half, and when they are otherwise arranged in respect to both upper and lower half of the box, as set forth.

240. SEWING MACHINES; Louis Planer, Assignor to self and Joseph Auger, City of New York.

Claim—The combination of the peculiarly constructed notch which is confined to the upper half of the shuttle, and leaves the lower half intact, with a driver having a single horn or finger, which entering the said notch constitutes a guard to prevent the flying up of the heel of the shuttle.

241. HARVESTING MACHINES; George W. Richardson, Assignor to self and G. M. Weed, Grayville, Illinois.

Claim—The application of the rack upon the reciprocating bar and pinion upon the vertical shaft, connected and arranged for operating the two sickles at the same time by the cam wheel.

242. DAMPER FOR COOKING STOVES; Lyman L. Thomas, Dighton, Massachusetts, Assignor to the Dighton Furnace Co.

Claim—A damper placed in the outlet of the return flue of a cooking stove, near the termination of said flue, and of such a form that when secured or hinged at its lower end to the side of the flue opposite the oven, and when partially or fully closed it shall stand in a position more or less diagonal across the flue, and of such a length that it can never be moved more than twenty-five degrees from a perpendicular.

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243. MODE OF SETTING LOGS IN SAW-MILLS; Asa Brooks, Tolland, Connecticut.

Claim—The application and combination of the gear and screw-shaft, the traveling ratchet and chock, the stops and the spring pawl, for the purpose as described.

244. BREAD SLICER; H. F. Bond, Hudson, Wisconsin.

Claim—1st, The movable tray operated automatically by the motion of the knife, in the manner set forth. 2d, The bar, arranged as described.

245. TWEER; S. L. Bond, Greenwood, South Carolina.

Claim—The arrangement and combination of the two pipes, C C, having their orifices opposite to each other, with the air chamber, so that the two currents of air on entering the chamber will oppose each other, and thus uniformly diffuse the air, as described.

[The invention consists in introducing air from the bellows-pipe, and compressing it to a certain degree into an air chamber, the cover of which is perforated with a number of holes, so that the air escaping from the chamber is spread over a comparatively large area and with a uniform force. This cover when burnt out is so arranged as to be easily replaced by a new one.]

246. IRON FOLDING BEDSTEAD; John Biberthaler, City of New York.

Claim—The arrangement of the bed bottom in two parts, one of which, A, being about two-thirds of the whole length of the bed, and to which the legs are attached capable of turning under said part, when required, and attaching the other part, D (and which forms the upper or head part of the bed), to the legs nearest the head, in such a manner that the said part, D, may be turned over the top of the bottom part, A, while the legs to which the same is attached are turned under the said part, A, in the manner described. Also, fixing the head part of the bed, D, when unfolded, either to the legs, B, or to the bottom part, A, by means of bolts or pins, in such a manner that by said bolts the inclination of said part, D, may, at the same time, be regulated to any desired position.

247. REEFING SAILS; Henry Bessling, City of New York.

Claim—The slides, applied to work along the jackstay, or other suitable portion of the yard, in combination with reef-points extended from the back sail up through the jackstay or yard, and with the reef pendants. And, without confining myself to the particular construction of the pawls, I claim securing the reef by means of pawls applied to the yard, to operate in combination portions of the reef pendants made of chain.

[This invention consists in carrying the points of each reef of a sail up to the yard, and attaching them to slides which are fitted to work along the yard, and to which are attached the reef pendants. By hauling on the reef pendants, the slides are caused to move longitudinally, and to draw up the reef points, and so reef the sail from the deck.]

248. STEREOSCOPIC INSTRUMENTS; Alex. Beckers, City of New York.

Claim—1st, Placing the eye-glasses in a movable cylinder, in such a manner that opaque pictures, placed back to back, may be viewed by the same pair of eye-glasses, the direction of the said eye-glasses being varied by the partial rotation of the cylinder, to suit the opposite position of the pictures. 2d, The construction of the picture-holders with a double hook.

249. MACHINE FOR STONING CHERRIES; E. C. Custer, Evansburgh, Pennsylvania.

Claim—The machine for stoning cherries, constructed in a manner specified, with its spirally grooved cylinder and adjustable stripper, arranged as set forth.

250. FLOUR BOLTS; J. M. Clark, Philadelphia, Pennsylvania.

Claim—The slide valve, or a series of slide valves, without holes in them, so arranged and operating with the apertures in the sides of the bolting chest, that either of these apertures can be opened or closed or both closed when required, for the purpose of turning the material as desired, in either of the three directions.

251. STEAM HEATING APPARATUS; B. Wells Dunklee and W. B. Moore, Boston, Massachusetts.

Claim—The combination of the tubes, casing, inner and outer reservoirs, and condensation pipes, and escape pipe, with its valve, with petticoat chamber and vaporizing pipe, and the use of the iron known as the Poleux patent metal alloy coating, as set forth.

252. DOOR FASTENING; Charles Frost, Waterbury, Connecticut.

Claim—The employment or use of the drop plate, constructed of the form and applied to the door or doors, as set forth.

253. HARVESTERS; Henry Fisher, Alliance, Ohio.

Claim—Attaching the draft or draw bars to the arms, L L′, in the manner set forth. Also, the peculiar arrangement and combination of frames, tongue, spur, and arm, g, in relation to each other and to the main shaft, to operate in the manner specified.

254. MACHINE FOR FEEDING PAPER TO PRINTING PRESSES; G. H. Ferguson and Sylvester Ferguson, Malden Bridge, New York.

Claim—Feeding sheets of paper, singly, to a printing press, paper-ruling, or other machine, requiring the feed of a single sheet at a time, by means of a feed roller, G, feed roller, I, and adjustable friction stop, or the equivalents thereof, arranged as specified.

255. LOCOMOTIVE BOILERS; B. L. Griffith, Hazleton, Pennsylvania.

Claim—The deflectors, arranged within the space between the fire-place and the tube sheet of a locomotive boiler, in combination with openings in the fire-box for the admission of atmospheric air.

256. SEWING MACHINES; E. A. Goodes and E. L. Miller, Philadelphia, Pennsylvania.

Claim—The combination of the needles, the hook, and the tongue, arranged as described.

257. SUBMARINE HELMET WINDOW; C. M. Gould, Worcester, Massachusetts.

Claim—The application to submarine helmets of the above described window, in the manner described.

258. PIANO-FORTES; Charles Glassborow, Philadelphia, Pennsylvania.

Claim—Constructing the string frame of an upright piano with two pin blocks, and other appliances for receiving two sets of strings, and two distinct sounding boards, the strings being arranged one set on one side, and the other set on the opposite side of the frame, the two sounding boards being connected together, and the whole being otherwise constructed in the manner set forth.

259. VALVES FOR WATER-CLOSETS; James Gilfillan, Hartford, Connecticut.

Claim—The combination of elastic tubular spring, piston, and chamber, operating in the manner described.

260. FURNACES OF LOCOMOTIVE ENGINES; Richard Gill and G. W. Grier, Altoona, Pennsylvania.

Claim—In combination with the fire-box of a coal-burning locomotive boiler, a water deflector, having a series of small openings through it, and extending up over the fire, as represented, and an air passage behind or over it, which communicates with the external air, for the purpose of introducing atmospheric air in small jets over the fire.

261. PUMP; Enos Hartzler, Orville, Ohio.

Claim—The arrangement of the pipes, valves, springs, x x x x, and spring, a, with the rod, box, and stock, combined and operating as specified.

262. SAWING MACHINE; E. H. Hancock, Augusta, Georgia.

Claim—1st, The combination of the yielding guard levers, or their equivalent, with the rotary saws, as described. 2d, The head blocks, swinging guide, circular saws, and guard lever, arranged as set forth.

263. SEWING MACHINES; Wm. Hall, North Adams, Massachusetts.

Claim—1st, The combination of the needle-carrier, pivoted bar, connecting rod, J, slide, I, pitman, and crank, arranged in the manner set forth. 2d, The combination of slide, I, and rod, J, or its equivalent, with a vibrating needle-carrier, in such manner as to produce two vertical motions on the needle, during each single horizontal motion of the slide, I, in the manner set forth.

264. WASHING MACHINE; George Hall and Alonzo Scudder, Morris, New York.

Claim—The employment of a corrugated flexible metallic concave, stretching across the lower part of the machine, as described.

[A corrugated concave is used in connexion with a swinging, corrugated, and convex rubber, both being placed in a suitable box or case.]

265. ROTARY PUMPS; C. H. Hersey, Boston, Massachusetts.

Claim—The combination of the flanched shaft with the hinged valve and cone, as described.

266. BEDSTEAD; Benjamin Hinkley, Troy, New York.

Claim—The arrangement of the dovetailed tenons on the end rails, and corresponding dovetailed mortises in the full posts, with the side rails and longitudinal tension rods, as set forth.

267. WATER AND ALARM GAUGE FOR STEAM BOILERS; F. A. Hoyt, Boston, Massachusetts.

Claim—The arrangement of the balanced valve chamber and valve, the leading pipe thereof, and the whistle, with reference to the dry steam chamber, the indicator chamber, and the valve lever, and the indicator hand, connected together and arranged in the two chambers, as specified.

268. PRINTING MACHINES; Richard M. Hoe, City of New York.

Claim—Stopping the sheet of paper as it issues, after its first side is printed, and imparting to it a retrograde motion, thus returning it backwards, or in reverse order, to the impression cylinder, for the purpose of printing the second side, by the means described.

269. FORCE PUMPS; Frederic Kettler, Milwaukie, Wisconsin.

Claim—The combination and arrangement of a force pump, as described.

270. FORCE PUMP; Frederic Kettler, Milwaukie, Wisconsin.

Claim—The combination and arrangement of a force pump, as described.

271. MILLS FOR CRUSHING QUARTZ; George T. and Wm. F. Kearsing, Butte City, California.

Claim—The arrangement and combination of the driving shaft, arms, rods, and runner, as described.

272. MACHINES FOR ENAMELING MOULDINGS; Robert Marcher, City of New York.

Claim—1st, The elastic or yielding sides of the hopper, arranged as set forth. 2d, In combination with the hopper, the reciprocating dog attached to the bed, and operated as shown, and also in combination with said hopper, the feed rollers, either or both feeding devices being employed for the purpose specified.

273. BEDSTEAD; Charles Messenger, Warren, Ohio.

Claim—The angular and oblique slot and pin, in combination with the plate or key, when arranged in connexion with the jointed rails, as described.

274. SEWING MACHINES; Joseph W. Morton, Plainfield, New Jersey.

Claim—My improved loop-check or thread-holder, for the Wheeler & Wilson sewing machine, viz: a loop-check or thread-holder, which is composed of hair bristles, or other suitable fibres, by compacting them

into a firm mass of suitable size, and then combining the same with a sewing machine, in such a manner that the ends of the said fibres will bear against a portion of the rotating hook of said machine.

275. MACHINES FOR MANUFACTURING WAVED AND CORRUGATED METAL PLATES; Richard Montgomery, City of New York.

Claim—The combination of the peculiarly constructed roll, I, with the peculiarly constructed roll, J, arranged in relation to each other, as shown, whereby the manufacture of the waved corrugated metallic plate, with margins of greater thickness than the middle, as patented to me on the 21st of June, 1859, is facilitated, while a portion of each corrugation is formed at the same time, as described.

276. MACHINE FOR MANUFACTURING WAVED AND CORRUGATED METAL PLATES; Richard Montgomery, City of New York.

Claim—The combination of the peculiarly formed roll, I′, with the peculiarly formed roll, J′, arranged and operating in relation to each other, as shown and set forth, whereby the manufacture of the waved, corrugated, metallic plate, with margins of greater thickness than the middle, as patented to me on the 21st of June, 1859, is facilitated, while only "one corrugation" is formed at the same time, as described.

277. SHIRT STUDS; Daniel Morris, Bangor, Maine.

Claim—The improved manufacture of shirt studs, as constructed, with a metallic facing and an anti-soiling spool or guard, arranged as specified.

278. PLATFORMS BETWEEN RAILROAD CARS; Joseph Newman, Baltimore, Maryland.

Claim—The expanding mesh or lattice work described, when attached by a single point at each end, in the manner set forth, to be used as a bridge or gangway between railroad cars.

279. GATES FOR RAILROADS; Ira Robbins, Hughesville, Pennsylvania.

Claim—The shafts, s s′, having arms, as described, in combination with the shaft, B, lever, A, train of wheels, c c c, spring detent, g, spring, f, and the several rods connecting the aforesaid parts, as set forth, for operating the sliding gate.

280. SPRINGS FOR RAILROAD CARS; David B. Rogers, and Joel A. Wood, Pittsburgh, Pennsylvania.

Claim—The combination of a series of plate springs, arranged as described, with a box in which they are inserted, and a follower, the spring box being either separate from or forming part of the truck, in the manner set forth. Also, making and using the plates or leaves of the spring of different thicknesses in the same series, for the purpose of adapting the spring to the varying degrees of pressure to which it may be subjected from time to time.

281. GOLD WASHERS; Harrison Roberts, Mormon Island, California.

Claim—The arrangement of the sluice, in combination with the hopper and with the supply channel, in such a manner that the water strikes the dirt from below, and that the hopper is made self-supplying.

282. BISCUIT BOARD; Isaac R. Shank, Buffalo, Virginia.

Claim—The arrangement and combination of trap-boards, beveled strips, levers, and vertical pins, in the manner set forth.

[This is a frame or chest so constructed as to hold meal and flour, with a table on the top on which the dough can be worked, and trap-doors in this table which, when closed, are perfectly flush with it, can be opened into the flour or meal receptacles by simply pressing on pins, they being opened and closed by a system of levers and pins.]

283. SHIRT STUDS; Henry Simon, Providence, Rhode Island.

Claim—The movable elbow piece, spring, and lever, applied in combination with each other and with the fixed shank, and in relation to a fixed elbow piece, as described.

284. SEWING MACHINES; Isaac M. Singer, City of New York.

Claim—Making the needle-carrier with a mortise, in combination with the needles, a series of blocks having parallel sides grooved to receive the needles, and with a clamp screw, or its equivalent.

285. NINE-PIN BALLS; John Taggart, Roxbury, Massachusetts.

Claim—The nine-pin ball, composed of a hollow metallic body and a covering of india rubber, or other suitable elastic material.

286. BORING TOOLS; George J. Washburn, Worcester, Massachusetts.

Claim—Giving the stock or shaft of a boring screw, driving, or other tool, a continuous rotary motion in one and the same direction, by means of a nut or sleeve, which is moved in a rectilinear reciprocating direction on said shaft.

287. CONSTRUCTION OF RAILROADS; Amos Webb, Savannah, Georgia.

Claim—The arrangement of the ties in alternate reversed inclined positions, as described.

[This invention consists in placing or laying the ties or sleepers of railroads angularly in the ground, or in such position that their sides will be inclined relatively with vertical planes and their upper surfaces inclined from a horizontal plane.]

288. APPARATUS FOR WARMING BY STEAM; Charles A. Wilson, Cincinnati, Ohio.

Claim—The valves, adapted and arranged in the lower or discharging end of the branches, coils, or radiators of a system of steam heating pipes, and closable automatically by heat, in the manner explained.

289. STEAM RADIATOR; Charles A. Wilson, Cincinnati, Ohio.

Claim—The arrangement of a series of tubes or boxes provided with corresponding apertures and nozzles, to permit circulation of steam and receive bolts or rods, which extend from top to bottom of the tier, the whole being adapted to admit of varying the extent of radiating surface while that of the floor room occupied remains unchanged.

290. CHURN DASHERS; Parker Wineman, Loydsville, Ohio.

Claim—A cylindrical dasher for churns formed with a perforated top provided with a movable cap or cover and with hinged valves, arranged in such manner that cream may be received within the dasher at each downward motion thereof.

291. SAFETY GUARD FOR A FERRY WHARF; Edward F. Woodward, Brooklyn, New York.

Claim—The employment of the apron, for the purposes set forth.

292. Venetian Blinds; George H. Woodworth, Brooklyn, New York.

Claim—The eyes or staples passing the cords and attaching the tapes to the blind slats, in the manner specified.

293. Ore Washer and Amalgamator; John N. Wyckoff, Brooklyn, New York, and Thomas M. Fell, Orange Mines, Virginia.

Claim—A concentrator, constructed with a series of boxes or partitions, having curved bottoms communicating one with the other, and driven transversely for the purpose of separating poor from rich deposit.

294. Gold Amalgamator; John N. Wyckoff, Brooklyn, New York, and Thomas M. Fell, Orange Mines, Virginia.

Claim—The application of heat by steam, or otherwise, to vessels, pans, or cylinders, keeping the contents well triturated or mixed at an elevated temperature, so as to amalgamate the prepared ore by the use of mercury and alkali, as specified.

295. Wood Saw; Eliza Blake (Executrix of Robert Blake, deceased), Assignor to Blake & Son, Albany, N. Y.

Claim—The new manufacture of wood saws, in the manner set forth, meaning by this, to claim only the sole right to manufacture, according to the mode of construction herein set forth, the special kind and character of saws known as wood saws, and clearly defined and represented in the description and drawings.

296. Clothes Frame; J. Burr, Baltimore, Maryland, Assignor (through mesne-assignment) to George A. Fayman, Washington City, D. C.

Claim—The seat, capable of movement on the shaft in one direction only, and provided with the weighted detent and the ring movable thereon without bearing against the shaft, in combination with the shaft, arms, braces, and cords, arranged as described.

297. Piano-fortes; J. W. Fischer, Assignor to self and Charles Fischer, City of New York.

Claim—The bar beneath the dampers and above the piano strings, actuated by the levers, or their equivalents, in the manner specified.

298. Screw Stocks; Simeon Goodfellow, Assignor to self and John Fish, Troy, New York.

Claim—The cutting die, in combination with the vibrating circular plug and the movable holder, arranged as specified.

299. Churn; Alfred Guthrie, Assignor to Wardell Guthrie, Chicago, Illinois.

Claim—The combination and arrangement of the cranks connected by the plate, or its equivalent, in the manner described.

300. Glass-polishing Machines; Albert H. Hook, City of New York, Assignor to Wm. A. Horstman, Brooklyn, New York.

Claim—The combination of the apparatus for producing the reciprocating longitudinal motion and continuous lateral motion given to the polishing blocks, consisting of the screws, worm-wheel, worm, and its connexions with the driving power.

301. Fire-escape Ladders; Hezekiah Johnston and Wm. J. Matthews, Assignor (through mesne-assignment) to Hezekiah Johnston, Collinsville, Illinois.

Claim—The combination of the endless belt with the folding ladders and the platform, in the manner described.

302. Machine for Cracking Sugar; James H. Murrill, Assignor to Egerton, Dougherty, Words & Co., Baltimore, Maryland.

Claim—The employment of a vibratory saw, in combination with a gauge plate and hopper, arranged for sawing off slabs of sugar and directing them between crushing rollers. Also, the employment of rollers moving in unison with each other, constructed with cruciform cutters, for the purpose of perfectly dividing slabs of sugar into regular cubic portions. Also, the construction of a hopper provided with parallel grooves, or their equivalent, in combination with a circular saw, constructed in the manner set forth.

303. Coffin Screw; W. H. Nichols, Assignor to A. H. Markham, W. H. Nichols, and David Strong, East Hampton, Connecticut.

Claim—The employment of plates, or their equivalent, for the purpose of securing or retaining the caps or covers of coffin screws or tacks.

304. Hoisting Cranes; J. Y. Parce, Assignor to self and D. B. DeLand, Fairport, New York.

Claim—The main arm of a crane, arranged with the double diagonal braces and with the guide rollers, to operate in combination with the arm jointed to the same by means of the oval pin, as set forth.

305. Portable Sawing Machine; Samuel R. Smith and Philander P. Lane, Assignors to Lane & Bodley, Cincinnati, Ohio.

Claim—1st, The idle friction pulley, operating in combination with the arbor and feed driving a circular saw. 2d, In the described connexion with the transverse rack, the gearing, ratchet wheel, pawls, lever, and stop, which operate, by their rigidity, in one direction, to transmit a forward movement of the rack to the knee, yet permitting the retraction of said rack. 3d, The described arrangement and adaptation of the weighted eccentric friction pawl, for the exact retention of the knee to the place of setting. 4th, The described arrangement and adaptation of the perforated rack, pinions, knee, and screen, for the exclusion of dust.

Extensions.

1. Fan Mills; Isaac T. Grant, Shagticoke, New York; patented July 10, 1845; extended July 5, 1859.

Claim—The manner in which I have arranged the screen and the chess-board, and combined them with the screens ordinarily used, so as to obtain two distinct currents of wind, and to subject the falling grain to the stronger currents below the screen and chess-board, thereby blowing off the heavier portions of foreign matter, whilst the chaff is blown off by the ordinary currents in the upper compartments of the shoe.

2. Shaping Irregular Surfaces in Wood; Warren Hale and Allen Goodman, Dana, Massachusetts; patented July 22, 1845; extended July 26, 1859.

Claim—The method of copying or forming the longitudinal irregularities of piano legs, and other similar articles, on rough blocks of wood, by means of a carriage moving longitudinally against the revolving cutter, and holding both the pattern and the rough block, the cutting tool being raised and depressed for depths of cut by rollers resting on the patterns.

ADDITIONAL IMPROVEMENTS.

1. PREPARING AND MOUNTING SLATES; Hubbard Beebe, New Haven, Connecticut; patented March 29, 1859; additional dated July 5, 1859.

Claim—The combination of leather, or cloth, or felt (or felting), instead of, or in addition to, india rubber and gutta percha, so far as beauty, and economy, and desirableness in use may require, with the metallic band or rim around the edge of the slate, as patented March 29, 1859. Also, the combination of leather and cloth with my metallic rim, or with a water-proof cement of such strength and stiffness as will warrant, to some extent, the disuse of said metallic rim, especially in mounting slates in portfolio form or forms.

2. HANGING WINDOW SASHES; Theodore F. Hall, Marietta, Ohio; patented December 21, 1858; additional dated July 26, 1859.

Claim—The improved arrangement of cords, pulleys, and weights, for hanging the sashes of windows, so that either or both sashes can be retained in any desired position in the frame, the sash and weights being suspended and moving on cords attached to the frame.

3. PICKER SAWING MACHINES; John Haw, Old Church, Virginia; patented June 23, 1857; additional dated July 26, 1859.

Claim—Attaching the saw guides to the overhanging bearing, so as to adjust them to the sawing of small logs.

RE-ISSUES.

1. FAUCET; Albert Fuller, Cincinnati, Ohio; patented October 16, 1855; re-issued July 5, 1859.

Claim—The elastic plug valve attached to a stem, when operated by an eccentric, or its equivalent, as set forth. Also, the elastic plug valve constructed as described, in combination with the cup-shaped cap to prevent the cup from spreading.

2. FAUCETS; James Powell, Cincinnati, Ohio: patented March 22, 1859; re-issued July 5, 1859.

Claim—The described arrangement of the cam, flanches, longitudinal slot, and spurs, combined and operating in the manner and for the purposes set forth.

3. BILLIARD-TABLE CUSHION; John M. Brunswick, Cincinnati, Ohio; patented December 8, 1857; re-issued July 12, 1859.

Claim—That order in the arrangement of the material composing a billiard-table cushion which places the cork in the rear, the rubber in front of it, and the paper, leather, and cloth, or the equivalents thereof, outside, in the manner set forth.

4. FIRE ENGINES; L. Butler and R. Blake, Waterford, New York; patented November 30, 1858; re-issued July 12, 1859.

Claim—Combining with the water way or channel, the air chamber divided into two compartments by contraction, at or about one-half the height of said air chamber above the base or point of attachment to said water way, in the manner set forth. Also, in combination with the hour-glass contraction of the air chamber, the ring enlargement of the rock-shaft, as set forth.

5. CLEANSING CAOUTCHOUC; Austin G. Day, Seymour, Connecticut; re-issued July 12, 1859.

Claim—The use of alkali, or its equivalent, for separating bark, sticks, or other foreign bodies from crude caoutchouc and other vulcanizable gums, to prepare them for manufacturing.

6. TREATMENT OF CRUDE CAOUTCHOUC; Austin G. Day, Seymour, Connecticut; re-issued July 12, 1859.

Claim—Charging the caoutchouc, or other like gum, with alkaline liquor, or the equivalent, by means of the exhausting apparatus described and represented.

7. CUT-OFF AND WORKING VALVES OF STEAM ENGINES; George H. Corliss, Providence, Rhode Island; patented March 10, 1849; re-issued July 12, 1859.

Claim—The method, substantially as described, of operating the slide valves of steam engines, by connecting the valves that open and close the ports at opposite ends of the cylinder with separate crank-wrists, or their mechanical equivalents, so that from the motion thereof each valve, while its port is closed, shall move a less distance than it moves in opening and closing its port, while at the same time the two wrists by which the two valves are operated, have the same range of motion, as described, whereby I am enabled to save much of the power heretofore expended in working the slide valves of steam engines, and by which also I am enabled to make a greater proportion of the movement of the valve available for effecting a free passage of the steam through the ports of the cylinder.

8. CUT-OFF AND WORKING VALVE OF STEAM ENGINES; George H. Corliss, Providence, Rhode Island; patented March 10, 1849; re-issued July 12, 1859.

Claim—The combination of liberating valve gear with valves which are moved parallel to their seats, and continue their closing motion after their ports are closed, and commence their opening motion before their ports open, as described.

9. CUT-OFF AND WORKING VALVES OF STEAM ENGINES; George H. Corliss, Providence, Rhode Island; patented March 10, 1849; re-issued July 12, 1859.

Claim—The combination, substantially as described, of an air cushion with the liberating valve gear of steam engines.

10. CUT-OFF AND WORKING VALVES OF STEAM ENGINES; George H. Corliss, Providence, Rhode Island; patented March 10, 1849; re-issued July 12, 1859.

Claim—The combination with the part of the valve gear that appertains to a liberated steam valve of an instrument moved by the power of the engine in such manner as to effect the closing of the liberated valve whenever the independent means provided for that purpose fail to act in time.

11. CUT-OFF AND WORKING VALVES OF STEAM ENGINES; George H. Corliss, Providence, Rhode Island; patented March 10, 1849; re-issued July 12, 1859.

Claim—The combination of a helical cam with the opening and closing mechanism of the steam valve, as described.

12. CUT-OFF AND WORKING VALVES OF STEAM ENGINES; George H. Corliss, Providence, Rhode Island; patented March 10, 1849; re-issued July 12, 1859.

Claim—The method, substantially as described, of regulating the velocity of steam engines by combining a regulator with a liberating valve gear.

13. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—Hinging the finger beam to the main frame, so that it can be folded up thereon, as described.

14. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—Hinging the coupling arm to the frame at one side of the main axle, and supporting it by a brace hinged to a frame on the opposite side of the axle, in such manner as to obtain among other things a wide basis for bracing on a short frame without interfering with the folding-up the finger beam against or upon the frame to render the machine more portable.

15. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—The combination of the crank and the bearing for its journal, the cutter, the coupling arm, and the hinge of its inner end, with a hanger which is made the common support for the hinge of the coupling arm and the journal of the crank, arranged as set forth.

16. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—The method of folding the finger beam upon the frame by aid of the coupling arm with a lifting lever and cord, or the equivalent thereof.

17. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—1st, The combination of a knuckle with the joint which connects the finger beam and coupling arm, and the lever for raising the finger beam off the ground, arranged as set forth. 2d, The combination of a lever, arranged to turn on a pivot and to vibrate laterally with notches, and a catch to support the lever at any required elevation, together with the coupling arm and finger beam suspended to it.

18. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—The arrangement of the hand lever, driver's seat, and foot lever, whereby the driver may, when necessary, employ both his hands and his feet to raise the finger beam.

19. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—The combination of the spring pawl and the teeth with the gib and key of the connecting rod and cutter.

20. MOWING MACHINES; C. Aultman and L. Miller, Assignors by mesne-assignment to C. Aultman & Co., Canton, Ohio; patented June 17, 1856; re-issued July 19, 1859.

Claim—The combination of the shoe which carries the end of the finger beam, next the main frame, with a hinge brace bar, whose axis of motion at the end connected to the main frame is in a line with that of the corresponding end of the hinged coupling arm.

21. MOWING MACHINES; Cornelius Aultman and Lewis Miller, Assignors by mesne-assignment to C. Aultman & Co., Canton, Ohio; patented June 17, 1856; re-issued July 19, 1859.

Claim—The combination, with the hinged coupling arm, of a hinged brace whose axis of motion, at the end next the main frame, coincides with that of the corresponding end of the hinged coupling arm.

22. MOWING MACHINES; Cornelius Aultman and Lewis Miller, Assignors by mesne-assignment to C. Aultman & Co., Canton, Ohio; patented June 17, 1856; re-issued July 19, 1859.

Claim—The construction and arrangement of the finger beam and the main frame, so that the beam may be turned on its hinge into an upright position, and then raised and leaned against the frame to elevate it out of the reach of obstructions and distribute the weight more equally upon the carrying wheels, when the machine is to be removed from one place to another where the mowing is to be done.

23. MOWING MACHINEE; Cornelius Aultman and Lewis Miller, Assignors by mesne-assignment to C. Aultman & Co., Canton, Ohio; patented June 17, 1856; re-issued July 19, 1859.

Claim—The combination of a hinged coupling arm, the finger beam, and a catch, whereby the finger beam can be turned, raised, and held up to render the removal of the machine from place to place more convenient and secure.

24. MOWING MACHINES; Cornelius Aultman and Lewis Miller, Assignors by mesne-assignment to C. Aultman & Co., Canton, Ohio; patented June 17, 1856; re-issued July 19, 1859.

Claim—Mounting the two driving wheels and one main gear-wheel upon a common axle, in combination with a ratchet wheel for each driving wheel, each ratchet wheel fitted with a pawl that can be made to stand in or out of gear with the ratchet teeth at will.

25. MOWING MACHINES; Cornelius Aultman and Lewis Miller, Asssignors by mesne-assignment to C. Aultman & Co., Canton, Ohio; patented June 17, 1856; re-issued July 19, 1859.

Claim—The combination of a ratchet wheel, a ratchet pawl, a spring acting on the pawl, and a bearing pin, or the equivalent thereof, for the spring, with the driving wheel and the axle of the main gear wheel, whereby one spring is made to perform the two duties of holding the pawl, both in and out of gear, with the ratchet wheel.

26. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—The combination of the inner shoe with a leading wheel, arranged as set forth.

27. HARVESTERS; Lewis Miller, Assignor to C. Aultman & Co., Canton, Ohio; patented May 4, 1858; re-issued July 19, 1859.

Claim—The combination with the shoe of an adjustable sole, of the peculiar double runner form described, whereby the sole can be adjusted directly to the heel of the shoe, without the intervention of a link rod and joint.

28. HARVESTERS; McClintock Young, Jr., Frederick, Maryland; patented September 21, 1858; re-issued July 19, 1859.

Claim—Connecting the handle of the rake to a transverse shaft in such a manner that the rotation of the said shaft, when aided by the curved guiding rod, or its equivalent, will impart the within described movements to said rake, viz: a sweeping axial movement from the inner edge of the sector-shaped platform (or a little beyond the same,) over to the forward portion of said platform, and at that point instantly changing to an axial horizontal movement across the platform to the starting point, and so onwards in regular succession.

29. CUT-OFF GEAR; George H. Corliss, Providence, Rhode Island; patented July 29, 1851; re-issued July 26, 1859.

Claim—Combining with the rocking levers, or their equivalents, for operating the valves, the shoulders on the spring bars, or their equivalents, as described. Also, in combination with the shoulders on the spring bars that operate the rocking levers, the employment of the gauge bars, or any equivalent therefor, to regulate the periods of closing the valves, whether the said gauge bars be regulated by a governor, or by other means.

30. RAILROAD CAR SPRINGS; David B. Rogers, Pittsburgh, Pennsylvania; patented Feb. 23, 1858; re-issued July 26, 1859.

Claim—Constructing a carriage or car spring of a series of two or more plates of steel, each of which is so curved or twisted that the longitudinal curve on one edge or side of each leaf or plate, shall be the reverse of the curve on the other side or edge; a longitudinal section through the centre of the plate midway from either edge is a straight line, or nearly so: said plates being so arranged relatively to each other that on both sides the curve at the edge of each leaf or plate, shall be in the reverse direction to the curve at the edge of the leaf or plate next above or below it.

31. TRIGGER-OPERATING REVOLVING-BREECH FIRE ARMS; James M. Cooper, Assignee of S. W. Marston, City of New York; patented January 7, 1851; re-issued July 26, 1859.

Claim—1st. So constructing the lock of revolving-breech fire arms, as that the trigger used to fire the pistol, when drawn back, raises the hammer to full cock and there retains it, the revolving breech or barrels being at the same time rotated so far as to bring the nipple of one of the chambers or barrels in the proper position to be struck by the hammer in its descent, and the trigger being held in a drawn position ready for instantaneous firing. 2d. The use of a fly-tumbler or vibrating tooth intermediate between the hammer and trigger in trigger-operating fire arms, and the peculiar arrangement of the parts of the lock in connexion therewith, hereinbefore described, whereby the tendency of the main spring to cause the descent of the hammer is neutralized when the hammer reaches the point of full cock, so that the hammer having been raised by the trigger, may either be permitted to stand cocked or fired immediately, at pleasure, and greater ease in firing and steadiness of aim are secured.

32. SKELETON SKIRTS; The Shelton and Osborn Skirt Manufacturing Co., Birmingham, Assignees of E. G. Atwood, Derby, Connecticut; patented October 19, 1858; re-issued July 26, 1859.

Claim—A skirt formed of elastic hoops and tape, or equivalent material, when the tapes are disposed across the hoops in opposite diagonal directions, and interlocked on opposite sides of the hoops at the point of crossing, and are confined thereto. Also, connecting the hoops by means of a series of loops formed by a continuous tape, or equivalent material, passing around the skirt, from one hoop to the other, in opposite diagonal directions, without interlooping or interlocking between the hoops.

33. SKELETON SKIRTS; The Shelton and Osborn Skirt Manufacturing Co., Birmingham, Assignees of E. G. Atwood, Derby, Connecticut; patented October 19, 1858; re-issued July 26, 1859.

Claim—A skirt formed of elastic hoops and tape, or equivalent material, disposed across the hoops in opposite diagonal directions, without being connected between the hoops, but connected to the hoops at suitable intervals.

DESIGNS.

1. COOKING STOVES; James Greer and Rufus J. King, Dayton, Ohio; dated July 5, 1859.
2. SIDES AND DOORS OF COOKING STOVES; James Greer and Rufus J. King, Dayton, Ohio; dated July 5, 1859.
3. SPOON AND FORK HANDLES; Henry Hebbard, City of New York; dated July 5, 1859.
4. SUN-DIALS; William W. Wilson, Pittsburgh, Pennsylvania; dated July 5, 1859.
5. FLOOR OILCLOTH; James Bogle, West Newton, Massachusetts, Assignor to self and Daniel Bogle, Dover, New Hampshire; dated July 5, 1859.
6. FLOOR OILCLOTH; James Bogle, West Newton, Massachusetts, Assignor to self and Daniel Bogle, Dover, New Hampshire; dated July 5, 1859.
7. STOVES; Garrettson Smith and Henry Brown, Assignors to J. G. Abbott and A. Lawrence, Philadelphia, Pennsylvania; dated July 5, 1859.
8. FIRE FRAMES; Wm. W. Stevens, Westbrook, Assignor to N. P. Richardson & Co., Portland, Maine; dated July 5, 1859.

9 to 12. CARPET PATTERN (four cases); E. J. Ney, Lowell, Massachusetts, Assignor to the Lowell Manufacturing Co.; dated July 5, 1859.

13. CLOCK CASES; John A. Mudd, City of New York; dated July 26, 1859.
14. COOK STOVE; David Hathaway, Assignor to Fuller, Warren & Co., Troy, New York; dated July 26, 1859.
15. COOK STOVE; George W. and John Pittock, Union Mills, Assignors to —— Mosher and H. M. Chase, West Providence, New York; dated July 26, 1859.
16. PARLOR COOKING STOVES; Wm. W. Stevens, Westbrook, Assignor to N. P. Richardson & Co., Portland, Maine; dated July 26, 1859.

AUGUST 2.

1. AXLE-BOXES FOR LUBRICATING ROLLING STOCK, &c.; Paul Francis Aerts, London, England; patented in England, March 19, 1858.

Claim—The wheel fixed on the end of the journal in railway rolling stock, raising water by centrifugal force, and the divergent for conducting the water over the greased surface of the journal or moving parts of machinery working in fixed bearings.

2. Casting Copper Cylinders; Freeborn Adams, Somerville, Massachusetts.

Claim—A tube or cylinder cast out of copper, and free from blow-holes, and other similar defects, when stated.

3. Knitting Machines; Jonas Bradley Aiken, Manchester, New Hampshire.

Claim—1st, The lever grooved eccentrically to its fulcrum, applied in combination with the sliding loop regulator to adjust the same for different lengths of loop. 2d. The stop-motion, consisting of the lever and its self-adjusting dog, the ring with its pins, or their equivalents, and the sliding bolt, or its equivalent, carrying the slipper.

4. Tool for Riving Hoops; William Baker, East Templeton, Massachusetts.

Claim—A hoop-riving tool, formed of a stock provided with suitable guiding surfaces, and differently arranged or set stock surfaces and knives for operation, as set forth.

5. Mode of Hanging Brake Rubbers; T. C. Ball, Keene, New Hampshire.

Claim—The combination of the brake-head and spring, also, the arrangement of the brake-beam, so as to allow its independent action upon brake-head and spring.

6. Show-case; Thomas B. Ball, City of New York.

Claim—The construction of a case or box divided into compartments, each box having a sliding cover, in combination with the spring covers and compartments.

7. Apparatus for Condensing Coal Oils; William T. Barnes, Buffalo, New York.

Claim—1st, The employment of a tube, the lower extremity of which is provided with tubular arms, the same being made to revolve, and being used in connexion with a tank partially filled with water, and a conducting pipe. 2d, The arrangement and employment of the tanks, constructed and used in the manner specified.

8. Apparatus for Generating Coal Oils; William T. Barnes, Buffalo, New York.

Claim—1st, The arrangement of the levers, L K and J, and rod, whether operated by a cam or otherwise, for the purpose of forming an automatic dust clearer to coal oil retorts. 2d, The employment of the spiral or screw flanches on the head of the retort for pushing the material away from the hole in the journal.

9. Mills for Crushing Sugar Cane; Daniel Bassett, White Water, Wisconsin.

Claim—1st. The arrangement and combination of the tongue and groove rollers, wiper, and "stripper," as described. 2d, The "stripper," when composed of spring caps and a movable cam, and when arranged and combined with rollers.

10. Elevators in Warehouses, Factories, Mines, &c.; Albert Betterley, Boston, Massachusetts.

Claim—1st, The combination of an automatic safety shipper and brake apparatus with an elevator, arranged to operate only to prevent an elevation of the car beyond a fixed limit. 2d, The combination of the weight, flexible rope or chain, with the shipping and brake-controlling mechanism.

11. Spring Bed-bottom; C. C. Bisbee, Rochester, New York.

Claim—The arrangement described of the slats, belts, rollers, cords, and springs, in the construction of spring bed-bottoms. Also, the unequal cams for the more perfect automatic adjustment of spring beds.

12. Machine for Raising Water, &c.; Abraham Bower, Pekin, Illinois.

Claim—The combination of the lazy tongs, the slide trough, and valvular bucket, as set forth.

13. Manufacturing Hoes; Samuel Boyd, Brooklyn, New York.

Claim—The employment of an anvil, having an inclined face, groove or recess, and socket, in combination with a mandrel, whereby the bevel or set of the blade and eye, and the form, thickness, and bevel of the interior of the socket or eye will be uniformly and simultaneously produced.

14. Pipe Tongs; J. R. Brown, Boston, Massachusetts.

Claim—The arrangement and application of the serrated surface or rack, the spring, and toothed stopper, with respect to the two jaw levers, the clamp nut, and the screw-pin, applied to the toothed jaw lever.

15. Draining Machine; Moses Bucklin, Grafton, New Hampshire.

Claim—1st, The arrangement of the platform with the cutter blade and plough-share, for the purpose of cutting underground drains. 2d, Arranging the blade with a sloping cutting edge, so that the same may readily pass over obstructions which may come in its way. 3d, The arrangement and combination of the platform, the cutter blade, and the plough-share, with the adjustable bars and wheels, to operate in the manner described.

16. Ironing Table; John F. Galley, City of New York.

Claim—1st. The treadle, the fulcrum arm, the upright shaft, the side jaws, the spiral spring, and the thumb-screw, arranged as described. 2d, The hollow screw collar on the shaft, constructed as described.

17. Portable Field Fence; T. B. Garside, Danville, Iowa.

Claim—The combination of the long main posts, short auxiliary posts, and triangular pivoted brace, or its equivalant, arranged as set forth.

18. Manufacture of Phosphoric Acids and Phosphates; Frederick Augustus Genth, Philadelphia, Penna.

Claim—The process of manufacturing phosphoric acid or phosphates, by treating the phosphates of iron, alumina, or lead, by means of sulphuric acid, or its equivalent.

19. Gas Burners; James Gilfillan, Hartford, Connecticut.

Claim—The improvement in gas burners described, consisting of a central exit tube supplied with apertures, surrounded by the gas chamber, having its discharge regulated by the mercury cup, the upper end of said pipe being furnished with a nozzle or jet-burner.

20. Cloth-holder for Washing Crockery, &c.; C. F. Greely, East Kingston, New Hampshire.

Claim—The described washing vise, constructed as set forth.

21. Churn; W. S. Hall, Quincy, Massachusetts.

Claim—The combination of the frame of stationary transverse bars with the rotary hollow shaft and hollow arms thereto attached for the introduction of air, and the solid arms attached to the shaft.

22. Recumbent Chair; P. J. Hardy, Boston, Massachusetts.

Claim—The peculiar construction and arrangement of mechanism described for actuating the back and leg rest, whereby they cannot only be brought from a vertical into a horizontal, or nearly horizontal position, so as to constitute a couch, but be maintained in such or any intermediate positions that may be desirable, such mechanism consisting of the levers, c c and d d, connected with each other, the back and leg rest or leg rest frame, respectively in manner as set forth. And in combination with the said construction and arrangement of mechanism for actuating the said back and leg rest, I claim the arrangement of the locking contrivance, whereby the back and leg rest, when placed in any desirable position, may be firmly secured in such positions or be released therefrom, as circumstances may require.

23. Breech-loading Fire Arms; A. V. Hill, Hinsdale, New York.

Claim—The combination of the bed-piece, breech-pin, and connecting rod, which in connexion forms the sliding process, and operating as described.

24. Sewing Machines; Hiram W. Hayden, Waterbury, Connecticut.

Claim—1st, The attachment of the looping hook to an arm, or its equivalent, which has a revolving motion, and also a vibrating motion, in a direction transverse to its revolution, in combination with a bobbin, arranged relatively to it. 2d, The stationary cam, applied in combination with the revolving arm which carries the looping hook, and with a spring and sleeve, or their equivalent, for holding the said arm in contact with the said cam, to produce the vibrating motion of the said hook. 3d, The combination of the stationary cam and the fixed portion of the bobbin-holder. 4th, The looping-hook, made and fitted to turn in the revolving and vibrating arm, and provided with a pin or projection, operating in combination with a fixed stop. 5th, The extension of the mandrel forward of the rotating hook, for the purpose of carrying the spring and a sleeve, or its equivalent, by which the revolving and vibrating arm, which carries the hook, is kept in contact with the cam from which it derives its vibrating motion. 6th, The adjustable pin, applied and operating in combination with the revolving and vibrating looping hook and the bobbin. 7th, Feeding the cloth or material to be sewed by means of one or more smooth-faced angular projections on the feed bar, or its equivalent, and one or more ratchet-like wheels attached to the presser, said wheels being arranged with the lowest portions of their peripheries, above the bottom of the presser foot, and the said projections pressing the material into one notch at a time of each wheel, and operating in combination therewith, as described.

25. Car Couplings; E. L. Keeler, Pittsburgh, Pennsylvania.

Claim—The combination of a beveled coupling-head, shaped as described, with a spring as a coupling for railroad cars.

26. Sewing Machines; David Kelsey, Harper's Ferry, Virginia.

Claim—The horned eccentric or cam, applied as described, in combination with the vibrating pressure pad and the feeding dog, sliding on the stem of said pad, and operated by means of a stud, or its equivalent, attached to the needle-bar.

27. Tooth Keys; B. F. Killam, Braintree, Vermont.

Claim—The hollow fulcrum, as described.

28. Harvesters; O. H. King, Salem, Iowa.

Claim—The arrangement and combination of the circular platform, rake, rod, guide way, endless chain or belt, wheels, and pin, arranged as set forth.

29. Revolving Fire Arms; S. C. Lewis and F. P. Pfleghar, Whitneyville, Connecticut.

Claim—1st, The centre-pin made in two pieces, one of which is fitted to the rotating cylinder, and to a rotating recoil shield with fins, and has applied to it within the cylinder a spring, and the other of which is fitted to slide and turn in the front part of the frame, and is capable of being locked to the frame 2d, The dog, constructed and applied as described, to constitute its own spring, and operating transversely to the hammer, in combination with a peripherical ratchet. 3d, The stop, constructed with a tooth in its front, and a projection on its back, and applied and operating in combination with a spring, a ring of notches on the rear of the recoil shield or cylinder, and a tooth on the tumbler. 4th, The recoil shield, constructed with a peripherical ratchet, a ring of notches, a central bore, and slots.

30. Brakes for Railroad Cars; H. A. Lincoln and H. T. Douglass, New Haven, Iowa.

Claim—The combined arrangement described of brake shoes, truck wheels, equalizing beams and springs, the former being outside of the wheels, and so supported as to rise and fall practically with the wheels, while the equalizing beams support the springs, and the springs are arranged between the wheels, and transfer the weight to be carried to the equalizing beams, the several parts acting in combination, in manner specified.

31. Harvesters; S. A. Lindsay, Unionville, Maryland.

Claim—The combination of the hinged guide-piece with the hinged platform, for the purpose of retaining the rake and the reels in their proper relative positions towards the platform, when the latter is raised or lowered. Also, the combination of the bar, shaft, and the hinged bar, with the movable frame of the machine, and the finger bar, for the purpose of raising and lowering the latter, without interfering with the free movements of the platform on its hinges.

32. Machines for Cutting and Binding Grain; Frederick Meyer, Naperville, Illinois.

Claim—1st, The combination of the movable gates, the sliding divider, and the movable platform, as described. 2d, The construction of the tongs, and the mode of operating them. 3d, The tucker, for the purpose of fastening the free end of the band, as described.

33. Machine for Excavating and Grading; Warren P. Miller, Marysville, California.

Claim—The use of the cylinders or wheels, for the purpose of depressing the chains so as to give to the excavators a proper inclination, and thereby facilitate the feeding and working of the same. Also, the construction and arranging of the excavators attached to endless chains, worked in the manner described, to wit: to fill and discharge, while traversing from one tumbler to the other, on the lower plane (from A to B), for the use and purpose of excavating and grading rail and turnpike roads.

34. Journal-boxes; John A. Montgomery, Williamsport, Pennsylvania.

Claim—A journal-box, formed of a sphere or segment of a sphere, fitting into a cup or concave, and prevented from revolving with the shaft or journal by a pin and slot, as described.

35. Washing Machine; J. T. Mudge, Dayton, Ohio.

Claim—Arming the side of the tub and the plunger with round-headed knobs or pins, to act on the clothes, and allow the water to escape freely as it is pressed out of the clothes being washed.

36. Apparatus for Tapping Water or Gas Mains; E. T. D. Myers and C. F. Thomas, Washington City, D. C.

Claim—The method of drilling, tapping, and inserting stop or other cocks into cast iron water or gas mains or supply pipes, in the manner as set forth.

37. Branch-holder for Bonnet Stands; J. R. Palmenberry, City of New York.

Claim—A branch-holder, made and constructed in the manner described.

38. Manufacture of Common Salt; Henry Pemberton, East Tarentum, Pennsylvania.

Claim—The combination of processes described for the purification of common salt, to wit: washing common salt procured by the evaporation of salt water containing chloride of calcium and other impurities, with a saturated solution of chloride of sodium, or brine rendered pure by the use of chemical re-agents, substantially in the manner described, and the repeated use, for that purpose, of the same brine, for an indefinite number of operations, by treating it, after each process of washing the salt, with suitable chemical agents, whereby it is restored to its original purity.

39. Refining Coal Oils; Henry Pemberton, East Tarentum, Pennsylvania.

Claim—Recovering the sulphuric acid used from the residuum resulting from the process of the purification of coal oils, with sulphuric acid, by treating the residuum with water heated or caused to boil by steam, or otherwise, in the manner described.

40. Meat Cutter; John G. Perry, Kingston, Rhode Island.

Claim—Combining the revolving knives with a cylinder or block having studs on its surface, as set forth.

41. Machinery for Making Roofing Cement; Phineas Pomeroy and J. G. Allen, Middletown, Ohio.

Claim—The employment of the double-walled tank, in combination with the hollow metallic cylinders and valves, arranged as set forth.

42. Carriage Hubs; Jesse Pruette, Aurora, Illinois.

Claim—The enlargement upon box, having an annular flanch, for the purposes specified, in combination with the nut and its flanch, arranged as set forth.

[An annular flanch, with a concave recess formed on its inner surface, is cast upon the butt-end of the box, and this is driven into the hub. On the opposite end of the box a metallic nut is screwed, having a flanch upon its inner surface which projects into a corresponding cavity in the hub.]

43. Machine for Turning Hollow-ware; Lyman P. Rood, Deposit, New York.

Claim—The combination of the rotating mandrel with the adjustable slide provided with the tool-rest and cutter, arranged as set forth.

44. Sickle-guards for Harvesters; Andrew Shogren, Chicago, Illinois.

Claim—The cutter guard, constructed in the manner described, in combination with the guard socket and wedge-shaped bolt.

45. Corn Huskers; Daniel C. Smith, Tecumseh, Michigan.

Claim—1st, The combination of forceps, lever, stop, spring, and post, in the manner specified. 2d, The combination with the forceps of the slotted post, nut, and fork, in the manner specified.

46. Seeding Ploughs; John S. Snider, Lancaster, Ohio.

Claim—The arrangement of the swinging frame, wheel, crank shaft, with the hopper and mould-board, together with the devices connecting said parts, as set forth.

47. Machinery for Moulding Candles; George A. Stanley, Cleveland, Ohio.

Claim—1st, The moving of the moulds any distance lengthwise of the candles to detach the moulds from the candles formed in them, and to withdraw the moulds from the candles and place the jaws of the clutches around them. 2d, Moving the moulds by the weight of the moulds, and boxes containing the moulds, to adjust the jaws of the clutches to the candles, and attach the clutches firmly to the candles, so that they may be raised at the same time at which the moulds are returned empty to their first position.

48. Apparatus for Defecating Sugar; Richard A. Stewart, St. Bernard Parish, Louisiana.

Claim—The combination of the retort, the vacuum cylinder, and the receiver, in the manner set forth, and these I also claim, in combination with the steam boiler.

49. Brick Machines; H. W. Stillman, Port Washington, Wisconsin.

Claim—The combination of the revolving moulds, feeder, and plate, arranged in the manner described.

50. Flour-packers; Samuel Taggart, Indianapolis, Indiana.

Claim—1st, The oil-pot with cap, when operated in connexion with the clutch-wheel and shaft. 2d, The cam, in combination with the barrel-lifter, constructed as set forth. 3d, The combination and arrangement of the friction-brake, rod, walking beam, packing shaft, and barrel-lifter.

51. Pointing and Threading Wood-screws; N. G. Thom, Cincinnati, Ohio.

Claim—1st, The combination of a rotating head containing two or more spindles or blank-holders, revolving round a central point with an intermittent motion, with an apparatus for pointing and threading screw-blanks, so arranged and operated that while one blank is being pointed and undergoing the other operations necessary thereto, another blank is being threaded by another part of the same machine. 2d, In combination with an apparatus for pointing and threading screw-blanks, simultaneously, or nearly so, by the same machine, the apparatus so constructed and operated that while the spindles are rotated, or changing positions, the threading cam, or other device for operating the threading tool and its connexions, remains stationary, and when the motion of the spindles around the central point is arrested, the other part, and all necessary parts of the machine, recommence motion. 3d, The spring-brake, so constructed and operated that when the spring is being depressed to withdraw it from the notch in the plate, S, it acts as a brake upon the periphery of the plate, T, to arrest its motion, and the parts connected with it, at the same time relieving the plate, S, and allowing it to revolve with the spindles. 4th, The quadrant-shaped grooved arm on the pointing tool-stock, which, in connexion with the spring, or its equivalent, receives the blank from the hopper, and conveys it to the grippers, and supports it while being pointed. 5th, In combination with the quadrant, I claim the reciprocating motion of the hopper for the purpose of depositing the blanks in the quadrant, to be conveyed to the grippers. 6th, The triangular grooved cam, in combination with the hopper, so constructed that when moved in one direction by the action of the tool-stock, or otherwise, the hopper is depressed, and when moved in a contrary direction the hopper is elevated, for the purpose of depositing the blanks in the quadrant, or other mechanical device for receiving them. 7th, In combination with an apparatus for thread-

ing and pointing screw-blanks by the same machine, I claim the worm, when combined with the gears, or equivalent arrangement, by which the revolution of the worm causes the spindles to rotate round a central point. 8th. The rocking feed levers, for the purpose of regulating the depth of cut of the threading tool. 9th, The ratchet and revolving cam, when combined with the feed lever, for the purpose of raising the cutting tool out of the thread, in its backward motion, and increasing the depth of cut of the threading tool. 10th, In combination with the rod for opening the grippers, I claim the movable nut which acts upon the thread in the edge of the rod, to withdraw the cone and release the screw. 11th, The traversing arm, in combination with the spring lever, or its equivalent, for the purpose of removing the screw from the grippers when released. 12th, The sliding cam, in combination with the threading cam, for the purpose of removing the screw from the grippers and releasing it. 13th, The arm on the threading tool-stock, in combination with the threading tool and rod, or its equivalent, for the purpose of giving the proper form to the thread, and curvilinear shape to the point of the screw. 14th, In combination with the spindles or blank-holders, I claim the gears on the spindles, for the purpose of equalizing their motion and causing them to revolve round the shaft, while changing their position, whether the driving-belt rests or acts on one or both the spindles.

52. Lubricating Compounds; Horace Vaughn, Providence, Rhode Island, and Wm. Hutton, Baltimore, Maryland, Assignors to H. Vaughn, aforesaid.

Claim—"The cooling compound solution," as described.

53. Hemp Brakes; Allen Wilson and George C. Fletcher, St. Thomas, Missouri.

Claim—The arrangement and combination of the plates, M M′, N N′, O O′, each pair of plates moving in opposite directions through the medium of double cranks upon shafts, I L, as described.

54. Ship's Hoisting Apparatus; D. J. Wilcoxson, Milan, Ohio.

Claim—1st, Arranging the pawl and ratchet so as to allow the hoisting shaft to turn backward in lowering without disconnecting the pawl from the ratchet. 2d, Forming the connexion between a friction pulley and hoisting shaft, by means of a pawl and ratchet, so that the friction pulley is only in connexion with the shaft while lowering. 3d, The combination of the friction pulley, friction brake, and friction lever, arranged so that by the movement of the brake the friction pulley is released to revolve with the shaft, and power of the brake simultaneously applied to the pulley to regulate the velocity of the shaft in lowering. 4th, Combination of the vibrating pawl plates, cam levers, and the eccentrics, arranged as described, to give motion to the hoisting shaft.

55. Manufacture of Hats; Wm. F. Warburton, Philadelphia, Pennsylvania.

Claim—The process described of perforating the bodies of hats, by means of heated metal points.

56. Mole Ploughs; Augustus Watson, Walnut Run, Ohio.

Claim—Suspending the coulter to the lever and guiding it between rollers, so that it may be raised or lowered independently of the beam or frame of the plough. Also, making one or both of the beam plates adjustable, for the purpose of adjusting the position of the coulter so as to give it the proper tip or inclination. Also, in combination with the beam plates and the coulter, the grooved guide rollers, for the purpose of guiding the coulter in its vertical motion, and preventing any side or twisting motion of the same. Also, in connexion with the coulter and mole, the pivoted tongue, in the manner described. Also, in combination with the coulter and the mole, the link, whose ends are secured by a screw sleeve, for the purpose described.

57. Manufacture of Lint; Robert D. Dwyer, Assignor to A. B. and Daniel Sands, City of New York.

Claim—Surgeon's lint, produced directly from new flax, in the manner set forth.

58. Bending Plough Handles; John G. Ernst, Assignor to self and S. R. Slaymaker, York, Pennsylvania.

Claim—1st, The employment or use of the form block fitted in the frame with the chain attached, with or without the weight, in connexion with the roller and the toothed segments and stop, the latter being attached to the bed in carriage, arranged as set forth. 2d, The arrangement of the lever connected with clutch, the connecting bar, and the lever attached to shaft, in connexion with the rod and lever or button, whereby the operation of the machine, so far as the gigging back motion is concerned, is rendered automatic throughout. 3d, The movable rack, when adjusted and arranged with the wheel, for the purpose of stopping the feed or forward movement of the carriage.

59. Brick Moulds; James A. Hamer, Reading, Assignor to self and Norris Maris, Kimberton, Pennsylvania.

Claim—1st, The combination and arrangement of the operating parts of the brick mould, as described. 2d, The combination of the sides and partitions of the mould, operating as described 3d, The combination of the levers with the arms and pins, for operating the sides and partitions of the mould, as set forth.

60. Sewing Machines; George L. Jencks, Assignor to self, George Kendall, and John Hendrick, Providence, Rhode Island.

Claim—1st, The combination in a single thread sewing machine of a perforated barbed needle, which is arranged obliquely to the feed movement of the cloth or material being sewed, with a pair of nippers, or other equivalent device, which will, as the inclined needle is operating to assist in forming the stitch, retain and present the thread to the needle, in a manner to allow the necessary loop to be formed, shortened, and drawn into or tight on the cloth. 2d, The combination with a barbed needle of the spring nippers, thread-guide, and adjusting nipper-closing bracket, arranged as set forth.

61. Clothes-dryer; Danforth Johnson, Assignor to B. B. Worden and Wm. Cadwell, Chicago, Illinois.

Claim—The employment of flexible braces, in combination with the freely-sliding collar on the spindles, for the purpose specified.

62. Bank Locks; Wm. Johnson, Assignor to self and Eibert Schumacher, Milwaukie, Wisconsin.

Claim—1st, Operating the regulator wheels or guard plates by the screw pins, which are susceptible of being changed in the holes of the plates, and in relation to each other, as set forth. 2d, The tapered indicators, stem and beveled plate of the stem, fitting into the tapered recesses, as set forth. 3d, In combination with a series of regulator wheels or guard plates operated as described, I claim the means for indicating the position of such plates. 4th, The cock-wheel or toothed disc, in combination with the tumbler and the regulator wheels or guard plates, as described.

63. Casting Chilled Plates; Robert Poole, Assignor to self and G. H. Hunt, Baltimore, Maryland.

Claim—Making the chill for casting plates in sections, when said sections are secured to a bed-plate in such a manner as to leave spaces between them, which are filled with sand, or other yielding material, in the manner described.

64. Machine for Winding-up Clocks; John B. Powell, Assignor to self and George B. Frick, Philadelphia, Pennsylvania.

Claim—Without confining myself to any specific arrangement of parts, I claim the spring lever, spring

pawl or catch, and ratchet wheel, with the supplementary lever, and permanent pin, or their equivalents, applied in the manner set forth, to the winding-up of clocks, or other machines, in which a spring or weight is used as a prime mover.

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65. Apparatus for Heating Evaporating Pans; H. O. Ames, New Orleans, Louisiana.

Claim—The arrangement of the parallel evaporating pipes with their elbows, and collars, and screw nozzles, passing through the bottom of the pan, and the parallel external supply and escape pipes, with the nozzles and union couplings for making the connexions with the nozzles.

66. Seeding Machines; John Andrews, Clinton, Massachusetts.

Claim—The arrangement and combination of the vibrating bars or blocks, frame, axle, cam, and seed slide, whereby the cam which operates the harrow also moves the seed slide, and the harrow bars have a horizontal vibration, and also a vertical play with the frame upon the axle.

67. Seeding Machines; John Andrews, Clinton, Massachusetts.

Claim—1st, The arrangement and combination of the blocks, circular plates, teeth, levers, and seed sliders, as described. 2d, The arrangement and combination of the covering apron, bar, blocks, rod, and lever.

68. Brakes for Railroad Cars; Francis Armstrong, New Orleans, Louisiana.

Claim—Making the adjustment from the pull or the coupling, when actuating on distinctly detached parts, namely, the latch and tongues. Also, in combination, the arms, bar, and levers, arranged as described.

69. Machinery to Feed Sheets of Paper to Printing Presses; Moses S. Beach, Brooklyn, New York.

Claim—1st, Feeding sheets to the impression cylinders of printing presses, by means of revolving arms or scrapers, operating in combination with rollers, in the manner described. 2d, Retaining the paper in connexion with the impression cylinders of printing presses during the process of printing, by means of holders, in the manner described. 3d, Detaching the paper from the impression cylinders, by means of deflectors, as described.

70. Cotton Cultivators; G. W. Beard, Canton, Mississippi.

Claim—The peculiar shape given to the scrapers or cutters, and their lateral and vertical adjustment, in combination with the adjustable plough beams, arranged in the manner set forth.

71. Cotton Seed Planters; E. P. Beauchamp, Preston, Georgia.

Claim—The arrangement of the box, axle, wheels, side-pieces or frame, bolt, beam, stock, follower, furrow opener, and brace, as described.

72. Shingle Machine; Laurent Beaudreau, Fond du Lac, Wisconsin.

Claim—The relative arrangement, for united operation, of the intermediate circular revolving saw, open reciprocating double carriage, toothed clamps, bars, rollers, springs, inclined or curved guiding plates, horizontal rocking cradles, cams, shafts, bars, and hinged flaps or pawls, in the manner described.

73. Watch Cases; Philip Bettle, London, England; patented in England, November 18, 1857.

Claim—1st, The attachment of the inner case containing the movement of the outer case, by means of pins or pivots, so that the movement case can be turned over, to face the open or closed side of the outer case, without being removed from the outer case. 2d, Attaching the pendant handle to the movement case, so that it forms one of the centres or pivots, on which the watch turns, in connexion and combination with a pin or pivot on the opposite side of the case. 3d, The particular form and manner of constructing the pendant, and attaching the same to the inner or movement case before described.

74. Fishing Reel; William Billinghurst, Rochester, New York.

Claim—The combination of the skeleton ring with the other parts of the reel, arranged in the manner set forth.

75. Composts; Edmond Blanchard, Greenfield Mills, Maryland.

Claim—A fertilizing compost, composed of lime, chloride of sodium, wood ashes, charcoal, wheat bran, chimney soot, and gypsum, combined in the proportion and manner described.

76. Machines for Cutting Paper; E. Burroughs, Rochester, New York.

Claim—1st, The employment or use of the reciprocating and oscillating knife, arranged to operate as set forth. 2d, The knife, in connexion with the cone of pulleys attached to the shaft, s, the hollow shafts with their respective gearing, and the shaft, R, with its gearing, and the racks attached to the knife-bar by the rods, arranged as set forth. 3d, The arrangement of the shaft, U, with spring, the arm, cone of pulleys, levers, rack, for the purpose of automatically changing the movement of the knife from a descending to an upward movement. 4th, The clamp formed of the vertical and horizontal plates, arranged so as to be adjusted by the screw and pinion or worm-wheel, pinions, and racks, the latter serving in the capacity of both racks and guides. 5th, Attaching to the shaft, F, an index, arranged to move over a graduated stationary plate, attached to the frame, for the purpose of enabling the operator to accurately adjust the paper beneath the knife.

77. Adding Machine; J. T. Campbell, Rockville, Indiana.

Claim—The arrangement of a series of wheels provided with ten cogs or teeth, and carrying the ten numeric figures on their outward faces, in combination with the stationary plate containing like numeric figures, arranged on the circle, surrounding each of the wheels in the series. And in combination with the parts above claimed, arranged as described, I claim the stop-bars, and spring slides, and oscillating arms or pawls with the cam, arranged for joint operation as set forth.

78. Seed Planters; Walter Clark, Palmyra, Illinois.

Claim—The arrangement of the reciprocating agitating rod, when passing through the adjustable seed discharge opening in the side of the hopper, with the frame, wheels, pins, teeth, hopper, and adjustable slide, constructed as set forth.

79. Corn Harvesters; W. Cogswell and C. A. Mathewson, Ottawa, Illinois.

Claim—The circular cutter and the reciprocating sickle, with its stationary toothed plate, in connexion with movable bed, or fingers, the whole being placed on a mounted frame, and arranged as set forth.

80. Corn Planters; J. P. Coonley, Farmington, Michigan.

Claim—The arrangement of seeding roller, gear wheels, slide plate, lever, adjustable teeth, coverers, and tracking gauge, constructed as set forth.

81. Corn Harvesters; B. T. Currier, Bath, Maine.

Claim—The arrangement and combination of the scythe-shaped cutters, rods, cranks, adjustable frame, and standards, as described.

82. Hoop Fastenings for Cotton Bales; Edward Davidson, Batesville, Arkansas.

Claim—Forming the socket of two parts to admit of the same being opened to receive the bent or doubled and lapped ends of the bale hoop, and closed to secure the ends of the hoop together.

83. Vulcanized Gums; Alva G. DeWolfe, Seymour, Connecticut.

Claim—The use of pulverized, vulcanized rubber, gutta percha, or other vulcanized gum, in the manner specified.

84. Centrifugal Gun; C. S. Dickinson, Cleveland, Ohio.

Claim—1st, The employment of a lever provided with a collar which surrounds the shaft, pivoted or hinged, and provided with a pin or rod, as specified. 2d, Operating the lever in one direction, by means of rod and its connexions through the centre of the shaft, and in the other direction by means of spring, for the purpose of discharging the balls from the barrel at the proper time.

85. Seats for Sleeping Cars; Rudolph Dirks, Philadelphia, Pennsylvania.

Claim—1st, The cushioned platform and the frame, F, with its detachable cushion and movable legs, in combination with the permanent partitions, the said platform and frame being hinged together, and otherwise arranged as set forth. 2d, The boards, G and K, adapted to and sliding in or against the partitions, and arranged so as to form the foot and head-boards for the couches. 3d, The frame, H, as hinged to the side of the car, and the frame, I, so hinged to the frame, H, that both frames may assume the positions illustrated in figs. 1 and 2, in combination with the partitions and their sliding frames, G. 4th, Forming the upper couch of the board, L, hinged to the side of the car, and one or more boards, M, hinged to the board, L, when arranged in combination with the permanent partitions.

86. Hemp-brakes; Zachariah Feagan, Palmyra, Missouri.

Claim—The arrangement and combination of the stationary bars, finger guards, vibrating spring levers, and cams, constructed in the manner set forth.

87. Printing Presses; Andrew Dougherty, Brooklyn, New York.

Claim—The combination of the inking apparatus at the side of the main cylinder of a press, with a carriage that can be moved from and towards the main cylinder, and with a stop that controls the position of the carriage.

88. Die for Swaging Bolt-heads; Albert Eames, Bridgeport, Connecticut.

Claim—Making dies for swaging bolt-heads, and other articles, in two or more parts, the parts forming the bottom being fitted to and in the part forming the periphery, and the whole fitted to and secured within the drop, or equivalent therefor. Also, in combination with the die, the bottom of which is made separate from, and inserted in, the part forming the periphery, grooving the periphery of the part forming the bottom for the escape of air.

89. Sewing Machines; J. P. Emswiler, Knight's Tower, Indiana.

Claim—The combination of the slide, or its equivalent, with the feeding mechanism, for the purpose of adjusting the bed to the feeding mechanism for materials of various thicknesses, without changing the position of the feeding mechanism. Also, in combination with the bobbin, arranged to vibrate on the shuttle, the longitudinal arched pressure spring.

90. Windlasses; Moses G. Farmer, Salem, Massachusetts.

Claim—The combination of the roller, the ratchet wheel, B, the retaining ratchet, and the actuating ratchet, with the lever and toggle-joint, E, so arranged that the thrusting power of the toggle-joint shall be wholly exhausted when the lever is fully depressed, and the joint, E, brought into a straight line which intersects the axis, and the point of the actuating ratchet which is in contact with a tooth of the wheel, B. Also, the means described of permitting the backward motion of the roller, viz: by causing the motion of the lever to release, alternately, the actuating and retaining ratchets through the agency of such means as the springs, the projecting arms, and the proper position of the collar.

91. Sewing Machines; C. N. Farr, Philadelphia, Pennsylvania.

Claim—The arrangement of the fulcrum slide, stops, and looping bar, for regulating and adjusting the motions of the looper. And, in combination with said looping bar, adjusted as described, I claim the rocking lever, fitting and acting as specified.

92. Governor Valves; Benaiah Fitts, Worcester, Massachusetts.

Claim—The manner of mounting the valve, that is to say, resting or supporting the valve, as shown at M, and retaining it into its seat, as shown at N, for the purposes set forth.

93. Cultivators; Perley F. Freeland, Newark, Assignor to V. R. David, Morris, Illinois.

Claim—The arrangement of the tongue, curved or segment bar, beams with screw-rod, and pendants and shares, attached as set forth.

94. Apparatus for Folding or Wrapping Papers; Edwin Gomez, City of New York.

Claim—The folders, formed with the lips and volutes, in combination with the intermediate twisters, in the manner specified.

95. Printing Presses; George P. Gordon and F. O. Degener, City of New York.

Claim—1st, Combining with the tympan frame the sheet-holding and relieving nippers or grippers, for the purpose of holding the sheet and for relieving the sheet from the type. 2d, The combination of a cylinder, or segment of a cylinder, with its wheel-bearers, the impression cylinder, roller pendants, and the racks or gearing. 3d, The frictionless roller, or its equivalent, in combination with the tympan frame, for the purpose of closing the tympan and properly laying the sheet upon the form in advance of the passage of the impression cylinder, or its equivalent. 4th, Operating the sheet-holding and relieving grippers by or through the motion of the tympan. 5th, Attaching a tympan frame to an adjustable bed in such a manner that they, at all times, shall retain their relative positions towards each other. 6th, Hanging, hinging, or attaching the inking apparatus to the frame of the press, or to the press, in such a manner that it may be turned, swung, or set aside, so as to allow the workmen to get at the form to make any necessary alterations, or to make the form ready, or for the purpose of using the bed as a composing stone.

96. Fire-boxes for Locomotive Engines; Ralph Greenwood, Altoona, Pennsylvania.

Claim—The midfeather, when used in connexion with a gas chamber and fire-box, provided with open-

ings, the parts being arranged relatively with each other to operate as set forth. Further, the cylinders, when applied to the orifices of the gas chamber and fire-box, and connected by a lever to operate simultaneously, as set forth.

97. POTATO-DIGGERS; Leonard B. Griswold, Penfield, New York.

Claim—The employment of a rotating head or disc, having teeth or spurs arranged around an upright shaft in a direction oblique to the axis thereof, in combination with the truck and driving wheels, or their equivalents, for giving the required motion.

98. SEED PLANTERS; W. D. Harrah and B. S. Baldwin, Davenport, Iowa.

Claim—1st. The combination and arrangement of the peculiarly constructed hopper, regulating plate, sliding frame, slides, pitmans, edged leading wheels, hinged seed tubes, grooved covering wheels, foot lever, caster wheel, and hand lever, as described. 2d, In combination with the hopper, the arrangement of the foot lever and hinged bar, when the latter is so hinged as to throw the points of the seed tube forward in their adjustment, or when the foot lever is depressed.

99. WATER-GAUGE FOR STEAM BOILERS; Robert S. Harris, Galena, Illinois.

Claim—The within specified manner of constructing and attaching the float stem to the boiler, whereby it is made to answer for carrying the float and as an index for indicating the height of the water in the boiler, and, if desirable, as a trip for opening a valve for an alarm whistle.

100. SEWING MACHINES; James Harrison, Jr., City of New York.

Claim—1st. The switching lever, constructed and operated as set forth, for directing the thread to the beard or barb of the needle, and preventing the escape of the thread therefrom. 2d, Controlling the feed and the stitch by the raising or lowering of the needle. 3d, Rotating the needle and carrying with it the thread, thus forming a twisted threaded-loop, as described.

101. MACHINE FOR CUTTING OUT WOODEN-WARE; George A. Hay, Berea, Ohio.

Claim—The rock shaft, in combination with the hoop-saw, arranged as described, and operated by means of the pinion, in the manner set forth.

102. WOOD-SAW FRAME; James Haynes, Hollis, Maine.

Claim—The inclined plane, ratchet, and the dipper or strainer, applied to the saw and frame, as described.

103. MODE OF GENERATING AND APPLYING ELECTRIC CURRENTS IN TELEGRAPHING; Stanislas Hoga, Wm. P. Piggott, and Septimus Beardmore, Middlesex Co., England.

Claim—The application to telegraphic instruments of currents of electricity, produced from metals or substances arranged in the earth, or in natural bodies of water, in the manner and for the properties and relations described.

104. STEAM BOILERS; Robert Hooper, Baltimore, Maryland.

Claim—1st, Contracting that part of the boiler immediately above the fire-flues, in combination with the widening and extending of that part which is beyond or in the rear and above the end of the fire-box, as set forth. 2d, Forming a water-circulating passage below, in rear, and above the fire-box, and nearly or wholly isolating said passage from the fire-box, by means of a large space existing between the fire-box and the partition walls of the said water-circulating passage, as set forth.

105. APPROACH-OPENING GATE; Anthony Iske, Lancaster, and Jacob B. Erb, Conestoga Township, Penna.

Claim—The arrangement of the platforms and uprights to the lever, with the connecting rod attached to the arm on the slat, the groove on the inside of the post, for operating a series of cross slats connected by pivots with the slats, combined in the manner set forth.

106. MACHINES FOR MILKING COWS; John W. Kingman, Dover, New Hampshire.

Claim—The teat-cups or tubes, partially covered at their upper ends with an elastic flanch, which will yield for the insertion of the teat, and gripe it so as to hold the cup upon the teat during the process of milking, and form a packing between the edge of the cup and the teat, which will be pressed against the teat by the external air when the internal air is exhausted; and, in combination with the device above claimed, I claim a vessel provided with an air-pump, and connected with said cup or cups by flexible tubes, so arranged as to exhaust the air and draw the milk from the cow, or other animal.

107. RAILROAD CAR WHEELS; Ebenezer A. Lester, Boston, Massachusetts.

Claim—Attaching the wheel to its axle by means of the auxiliary hub with its recesses and groove, and the segmental ring, or its equivalent, connected with the wheel, in the manner set forth.

108. SELF-ACTING BATTERY FOR SCARING CROWS, &c.; Theodore Lipshuts and Daniel C. Jones, Ballston Spa, N. Y.

Claim—The rising and falling box, arranged with the slide and apertures, and operating in combination with the dog and pulley, in the manner specified.

[The object of this invention is to arrange a battery with a number of chambers, in connexion with a gun barrel, in such a manner that its chambers, one after another, are made to go off at regular intervals without the aid of man, and, by these reports, frighten away injurious animals, and the invention consists in arranging a rising and falling box in such relation to a revolving battery, that when the box is filled with sand it sinks down and causes a hammer to discharge one of the chambers of the battery, and the box is so arranged that it discharges the sand when it reaches the ground, and it is raised by weights ready for a new charge.]

109. MACHINES FOR MILKING COWS; Samuel W. Lowe, Philadelphia, Pennsylvania.

Claim—The cup with the perforated diaphragm, constructed to receive all the teats of the cow's bag, by having an opening in the diaphragm for each teat, and combined with an exhausting apparatus, constructed as described.

110. DEVICE FOR MAKING ELECTRO-MAGNETIC CURRENTS CONSTANT OR INTERMITTENT; Moses Marshall, Lowell, Massachusetts.

Claim—The spring, so constructed and arranged as to be insulated from, or connected to, the two ends of the helical wire by springs, or otherwise, essentially in the manner set forth.

111. KITCHEN SAFE; W. McElwee, Shelbyville, Indiana.

Claim—The combination and arrangement of hollow posts with water cups, arranged in the manner specified.

[The body of this safe is mounted on hollow posts, extending from the floor to the top of the safe, and

they are provided with water cups near the bottom of each leg, which are connected by perforations with the compartments of the safe, so that cool air is always supplied to the safe without making perforations in its sides.]

112. Seeding Machines; E. McKenney, Montgomery, Ohio.

Claim—The arrangement and combination of the distributing discs, levers, check valves, and buttons, to operate together with the hammer and with the bell, as set forth.

113. Seed Planters; J. B. McMillan, Tipton, Indiana.

Claim—The planting and covering apparatus. when constructed and arranged in the manner set forth.

114. Underground Draining Machine; Adam Miller, Mt. Pleasant, Iowa.

Claim—The combination and arrangement of the mole with the drain protectors, for the purpose of expeditiously and economically giving protection to the upper part of the ditch, and of disengaging the protectors from the mole plough with facility after they are laid.

115. Drivers for Mill-stones; Alex. Miller, Newbern, North Carolina.

Claim—The employment or use of the friction rollers applied to the driver. in connexion with the plates, or their equivalents, fitted in the recesses adjoining the eye of the stone or runner, for the purpose of forming proper bearing surfaces for the rollers, the whole being arranged substantially as and for the purpose set forth.

116. Hoops for Skeleton Skirts; Samuel C. Moore, Providence, Rhode Island.

Claim—The corrugated sheet metal hoop for ladies' skirts described.

117. Devices for holding together the Panels of Portable Fences; Oliver P. Moran, Haynesville, Mo.

Claim—The arrangement of the notched projections or projecting pieces of the upper and lower rails, in combination with the right-angled notches in the end battens, in the manner specified.

118. Cultivators; Samuel Mowry, Womelsdorf, Pennsylvania.

Claim—The arrangement of the axles, wheels, d, stretch-bars, levers, frames, wheel, c, ratchet bar, and cultivator bar, constructed as described.

119. Hydro-carbon Vapor Apparatus; A. A. Moss, Philadelphia, Pennsylvania.

Claim—The steam generator and dryer, in combination with a distinct hydro-carbon vaporizer, the same being also connected with the retort, and the whole arranged together so as to generate the steam and hydro-carbon vapor separately, and for their subsequently mingling and combination.

120. Corn Planters; Matthew Mitchell, Alton. Illinois.

Claim—The arrangement of the frame. seats, hoppers, shoes, and cutters, with the device for operating them, in combination with the frame hung on the axle, and with the slides, operated as described.

121. Arrangement of Dead-beat Escapement; Don J. Mozart, Yellow Springs, Ohio.

Claim—The improved arrangement of the double "scrapers" with the star scape-wheel, or its equivalent, as specified.

122. Skates; Edward Norton, Boston, Massachusetts.

Claim—The metal straps, and the slotted plates and screw for tightening the skate to the foot.

[This invention consists in making the sole-plate, or what is more generally called the stock of the skate, of metal, and in two detached parts, and in pivoting them respectively to the heel and front parts of the runner, and in connexion with a skate thus made, in making the heel and toe straps for securing the skate to the foot of sheet metal, which are secured tightly to the foot by a peculiar fastening.]

123. Post-marking Stamps; Marcus P. Norton, Troy, New York.

Claim—The blotter, connected or attached to the main part of any "post-office post-marking stamp," for the purpose of cutting and inking, blotting and effacing, so as to successfully cancel the frank or postage stamp of any letter or any package, at the same time and operation of marking upon such letter or package the name of any post-office, the year, the month, and the day of the month.

124. Cultivators; Leonard Packard, Galesburg, Illinois.

Claim—The arrangement of the beams, the irons, and the projection on the ends of the beams, the adjustable arms, braces, blades, lifting rods, adjusting bar, levers, fulcrum, and hinged pole, as described.

125. Egg-beater or Churn; J. J. Parker, Marietta, Ohio.

Claim—The tube, in combination with the band and grated bottom, arranged in the manner described.

126. Clothes-frame; Horace Parkhurst, DeKalb, Illinois.

Claim—The combination and arrangement of the standards, the rails, the head-blocks, the clasps, the cords, as specified.

127. Mode of Uniting Solid Substances; Dubois D. Parmelee. City of New York, Assignor to J. A. Greene, Beverly, Massachusetts.

Claim—The method and process described of uniting various substances or bodies of the same or different character and properties, by the interposition between the surfaces of said substances or bodies to be united, of one or more sheets or layers of india rubber and gutta percha, separately, or when combined with the substances, such sheets or layers having previously been treated in the manner described, to produce the change specified—whereby, on completion of said change, a water-proof cement is obtained, which, while it possesses the requisite rigidity and coherence to keep the bodies firmly and strongly united, possesses a sufficient degree of elasticity to compensate for the expansion or contraction of the fibres of the bodies, for the purposes set forth.

128. Corn Planters; Lawson G. Peel, Webster County, Georgia.

Claim—The arrangement of the beam, stock, frame, bolt, hopper, wheel, and cylinder, as described.

129. Filing Cotton-gin Saws; Colwell P. Pool, New Market, Alabama.

Claim—The arrangement of the file-case with the file-holder and sleeves, to operate in combination with the bar, and with the slide and ridge, in the manner specified.

130. Sewing Machines; William F. Pratt, Bristol, Pennsylvania.

Claim—The construction of the thread-case with an angular projection extending across its centre, and the construction of the slide ring, or its equivalent, with a similar angular projection fitting to the said

projection. and operating in combination therewith in the manner specified, not only to prevent the twining of the thread-case, but to check and control the loops in their passage over said case, thereby avoiding the use of separate thread-controlling apparatus.

131. FURNACE FOR MAKING IRON DIRECT FROM THE ORE; S. M. Quimby, A. H. Brown, G. H. Renton, and James Criswell, Newark, New Jersey.

Claim—The arch, the hopper-damper, the rods or bars, arranged as described Also, the dampers at the bottom of the tubes, for discharging one or more tubes at the same time into one box or hopper.

132. APPARATUS FOR TANNING; John B. Read, Cold Spring, New York.

Claim—An improved apparatus for tanning and other purposes, said apparatus consisting of one or a number of smooth, porous, or perforated surfaces of wood, or other fixed material, placed singly or in succession in open or closed vats or vessels, or arranged in pairs so as to form closed hollow cases, upon which skins, or other substances to be operated upon, are to be smoothly stretched, and then the tannin or other fluids forced through them by hydrostatic or other pressure into the interior, whence means of escape are provided, as described. Also, the use of tarpaulin sheet metal, or other water-proof substances, in form of sheets, to cover over the perforated parts of the cases not overlaid by the skins, &c., that the fluids used may be afforded no passage except by percolating through the skins.

133. GAS RETORTS; Charles A. Robbe, Augusta, Georgia.

Claim—A gas generating chamber of a retort, made in two parts, when the said parts are constructed so as to lock together and form a tight joint by the simple act of sliding one portion into gear with the other.

134. SEED PLANTERS; Theodore B. Rogers, Wethersfield, Connecticut.

Claim—The arrangement of slides, lever, former, floats, adjustable pins, and markers, as described.

135. CULTIVATORS; James Rue, Englishtown, New Jersey.

Claim—The arrangement of the loose draft pole, bracket, cultivator frame, hinged rods, devices, bracket, and pin, arranged in the manner described.

[The invention consists in attaching the draft pole to the beams by means of hinged rods, which connect with the pole at a point above the pin, to which the draft animals are hitched, so that any strain exerted on that pin has a tendency to depress the rear end of the draft pole and to raise its front end, whereby the ploughshares are kept down to the ground without any extra exertion of either driver or animals, and as the pole is connected by hinged rods without any rigid fastening, the driver is enabled to accommodate the action of the shares to the inequalities of the ground, and at the same time the front ends of the shares can be raised and the cultivator drawn from place to place.]

136. SEATS AND COUCHES FOR RAILROAD CARS; Ezra D. Sargent, Indianapolis, Indiana.

Claim—1st, The side lounge or nurse couch, arranged as set forth. 2d, Its combination with the backs, seats, partitions, brackets, and stops, arranged as set forth.

137. GRINDING-CYLINDERS FOR APPLE-MILLS; John Shæfer, Lancaster, Pennsylvania.

Claim—The tangential, curved, longitudinal, toothed cylinders, as set forth.

138. NAIL-PLATE FEEDERS; John P. Sherwood, Fort Edward, New York.

Claim—The employment of the stationary inclined plane and the tumbler, having an inclined face, in combination with the arms of the hollow shaft of the plate-holder, and with the feed-screw and nut, and the driving cam, or their equivalent, operating together, as described.

139. APPARATUS FOR HEATING EVAPORATING PANS; Evan Skelly, Plaquemine, Louisiana.

Claim—The employment, in an evaporating pan, of a conical steam heater, with a central opening and a passage around its exterior and under its bottom.

140. SECURING ARTIFICIAL TEETH; N. B. Slayton, Madison, Indiana.

Claim—1st, Securing artificial teeth on plates of gold or silver, by means of an amalgam of gold or silver, or both, combined with mercury, as described. 2d. Forming, by means of said amalgam, an outer flanch or rim, covering and supporting the base of the teeth, as set forth.

141. STRAW-CUTTERS; Solomon P. Smith, Crescent, New York.

Claim—The arrangement of a crank shaft, pitman, knee-jointed lever, knife, with a straw box and cutter block, for conjoint use.

142. MORTISING MACHINE; Abel Spencer, Jr., Southport, New York.

Claim—The frame made with cross-heads connected together by means of the jointed rods, and having those rods jointed at or nearly in line with the cutting edge of the chisel, and the mode of applying or using it, or any other manner substantially the same.

143. TENONING BLIND SLATS; La Fayette Stevens, Elmira, New York.

Claim—Constructing the cutter-head with grooved cheeks, clamping nuts, and bearing studs, whereby the plane cutter knives are held in an oblique position with the plane of rotation with the cutting edge of the operating one, terminating in conjunction with that of the hollow hub and shoulder, arranged as set forth. Also, the combination and arrangement of the rest with stationary and movable upper and lower jaws and gauge, in the manner described. Further, the arrangement of devices for gauging the length of the slat, consisting of the automatic stop bolt, as operated by inclined plane and lever, to cause the carriage to stop alternately at the fixed stop-gauges.

144. BURGLARS ALARM; Stephen Stewart, Philadelphia, Pennsylvania.

Claim—The combination of the several parts, arranged to operate as set forth.

145. WASHING MACHINE; Wm. A. Suddith and John F. Suddith, Charlestown, Virginia.

Claim—The hinged part of cylinder, as set forth.

146. SEWING MACHINES; George S. Tapley, Bristol, Connecticut.

Claim—The movable cup and its appendages, for griping and automatically releasing the shuttle at intervals, as specified. Also, the construction and arrangement of the feed apparatus, set forth.

147. MACHINES FOR WASHING AND SEPARATING ORES AFTER BEING PULVERIZED; Horace Trumbull, Jersey City, New Jersey.

Claim—The application to a rotary buddle or table, such as described, of vibrating brushes, when the same are arranged and operated as specified.

148. Elevators or Hoisting Apparatus for Hotels, &c.; Otis Tufts, Boston, Massachusetts.

Claim—1st, For the purposes of elevating, the combination of the screw and the passenger car or platform. 2d, The construction of a screw for elevating, having stays or bearers at intervals, attached to the wall of a building or any fixed adjacent structure. 3d, The construction of a nut with the slot or opening in the back or side to enable it to pass by the bearings or stays before referred to, and as described. 4th, Constructing a nut or carriage with wheels or rollers running upon the thread of the screw, as described. 5th, Controlling the descending motion of elevators or hoisting apparatus by means of fluid retarders, constructed as described. 6th, Regulating the action of fluid retarders by means of a fly-ball governor, or its equivalents. 7th, The construction, arrangement, and operation of passenger cars of an elevator or hoisting apparatus, as described: that is, providing the platform with side walls and doors or gates, said doors or gates being combined with suitable mechanism arranged in relation to stationary cams or projections on the gallery floors, or any contiguous parts of the building, so as to open and close automatically, in the manner set forth. 8th, Opening and closing the doors of the galleries or landings automatically, by means of cams or projections on the car, through a system of compound or multiplying levers, arranged as described. 9th, Fastening and unfastening automatically the doors or gates of the car, by spring latches, or their equivalents, operated by cams or projections upon the gallery floors or adjacent walls of the building. 10th, Fastening and unfastening automatically the doors or gates of the galleries or landings by spring latches, or their equivalents, operated by cams or projections upon the car. 11th, The arrester, in combination with the fluid retarders, for the objects and purposes set forth. 12th, Passing the shipping rods and the cord or rod that operates the friction brake through the car or platform, for the purposes set forth.

149. Dumping Wagons; William B. Twiford, Chincoteauque, Virginia.

Claim—The three-sided, four-wheel, open frame, stationary crank axle, and long wagon body, arranged in the manner described.

150. Spring Bed-bottom; Felix Tylee, Cleveland, Ohio.

Claim—1st, The central support, constructed in the manner described. 2d, The combination and arrangement of upper slat, pin, supports, with central support, spring, and blocks, arranged as described.

151. Machinery for Sowing Fertilizers; Lorenzo Tyler, Havana, New York.

Claim—The arrangement of the frame, hopper, partition, adjustable slide, M, valve, cylinder, concave, adjustable slide, J, and flexible clasps, constructed as set forth.

152. Hose Coupling; George H. Van Vleck and Horace Tupper, Buffalo, New York.

Claim—The arrangement on the thimble of the head with two or more screw threads, having its upper end turned down, as described, and being provided with a projecting rim, to operate in combination with the thimble and with the nut.

153. Cultivators; Amsey Warren, Westport, Connecticut.

Claim—The parting or deflecting bar, hoes or shares, and rake, when applied to a suitable frame provided with wheels, arranged and combined to operate as set forth.

154. Knitting Machines; J. F. Waterhouse, Germantown, Pennsylvania.

Claim—1st, The application of a drum, or its equivalent, with detachable pegs, to operate a series of independent thread guides having independent springs. 2d, The striker, or its equivalent, arranged in respect to the thread guides, and operating so as to control such of the thread guides as are not under the control of any of the pegs in the drum. 3d, Moving the pegged drum, or its equivalent, at intervals first in one direction and then in another, by means of the revolving disc, and its two inclined projections, in combination with the ratchet wheel. 4th, Imparting a combined lateral and vertical reciprocating motion to the needle bars by means of the devices described.

155. Machine for Receiving and Piling Paper; J. A. Wilkinson, Brooklyn, New York.

Claim—1st, The accelerating bands and roller, arranged to project the sheets of paper successively over each other as they subside in the air, and in combination with the foregoing parts, I claim the endless apron receiving such sheets. 2d, The retarding bands, in combination with the delivering bands, for the purposes specified.

156. Rotary Presses; J. A. Wilkinson, Brooklyn, New York.

Claim—1st, The curved demi-grab with the sliding clamp and lip, for the purposes specified. 2d, The curved compositors' shield, for the purposes specified. 3d, The arrangement of the proof cylinder and rollers for inking the type on the proof cylinder. 4th, The plate and roller, for giving pressure in taking a proof from the types on the cylinder. 5th, The horizontal gudgeon and binding screw to secure the proof cylinder, and facilitate the correcting of the types. 6th, The movable clamping segments at the heads of the type or proof cylinder to secure the types in place, and also allow for the removal of portions thereof. 7th, Revolving the type cylinders in a trough containing alkaline, or other suitable solution for washing the types. 8th, The apron for leading the paper into the press, and on which said paper lies while receiving the first impression against the cylinder, thereby said feeding apron becomes also the tympan sheet. 9th, A curved arch or bridge, over which the paper or fibrous material passes, to give direction thereto and prevent buckling or twisting. 10th, Corrugating or forming ribs on said curved bridge in diverging lines, so as to spread the paper widthways, as the same passes over the bridge. 11th, The auxiliary frame hinged into the main frame, and carrying the upper inking apparatus, by the elevating of which both type cylinders are exposed to view or can be lifted out of their place for varying the composition, or otherwise. 12th, The manner specified of throwing off both impressions by raising the auxiliary frame and lowering the impression roller. 13th, In a rotary printing press an endless tympan sheet, let off a sufficient distance, and so fitted that the offset from the ink of the first impression does not again reach the paper until removed or sufficiently dry, so as not to produce blurring or offset on the paper. 14th, The arrangement of the ink rollers, I′ I″ I‴ I⁗, in the manner and for the purposes set forth, whereby the rollers, I′ I″, act to supply the required amount of ink to the rollers, I‴ I⁗, that supply and work the ink on the cylinder, I or I′. 15th, The arrangement of the ink rollers, i′, and workers, in their adjustable bearings.

157. Stump Extractors; Eri Wills, Augusta, Maine.

Claim—The combination of the frame, tongue, and shaft, with the wheels, ratchet device, levers, and chain, arranged as set forth.

158. Roofs for Railroad Cars; A. P. Winslow, Cleveland, Ohio.

Claim—The plates, caps, and grooved rafters, arranged as described.

159. Preparation of Glycerine; J. F. Wisnewski, Cincinnati, Ohio.

Claim—The employment or use and introduction of the within named chemicals, in the relative quantities, manner, and combination described.

160. Skeleton Skirts; Edward F. Woodward, Brooklyn, New York.

Claim—The sectional extension skirt, combined and attached to the circular skirt, the whole being arranged in the manner set forth.

161. Composition of Matter for Ornamental Purposes; Albert H. Wright, Camden, New Jersey.

Claim—The composition of the matter described, consisting of the clay and sulphur with the emery, or its substitute, combined together as described.

162. Machine for Printing in Different Colors; John K. Wright, Philadelphia, Pennsylvania.

Claim—Hanging the rollers for printing separate colors and patterns on separate frames, and arranging the said frames so that they may be adjusted independently of each other on the rails.

163. Revolving Stairs; Nathan Ames, Saugus, Mass., Assignor to self and Ward McLean, City of N. York.

Claim—1st, Arranging steps or stairs upon an endless belt, or in any manner equivalent, and placing them over rollers so as to form a revolving flight of stairs, which may be used both as a common flight and as an elevator. 2d, The triangular arrangement of the stairs, whereby an endless flight is made to pass around three rollers. 3d, The double parallel arrangement, whereby ascending and descending flights are placed side by side. 4th, The use of auxiliary stationary steps or stairs, to operate in connexion with the revolving stairs. 5th, The employment or use of rods or slots, to operate in connexion with the slotted stairs.

164. Construction of Lightning-rods; L. S. Baldwin and Lucius Parks, Assignors to L. S. Baldwin, aforesaid. Leroy, New York.

Claim—The employment of a quadrangular tube of sheet metal with spiral-fluted sides, in combination with the straight central supporting rod.

165. Sewing Machines; R. Eickemeyer, Assignor to self and E. Underhill, Yonkers, New York.

Claim—1st, The combination of the angular supporting plate, with a needle applied and arranged to work through an opening in the angle of the said plate, and obliquely to both faces of the said plate, for the purpose of sewing obliquely through any substance supported in the angle of said plate. 2d, The combination of the angular supporting plate, the obliquely arranged needle, and a looper, applied and operating so as in its movements to follow the angle of said plate. 3d. The combination of the looper, constructed with a two-pronged hook, and having a triple movement with a stationary guide, applied and arranged relatively to the needle and angular supporting plate. 4th, The arrangement of the feeding dog and presser in a swinging frame, so applied, in combination with the angular supporting plate, as to provide for the introduction and removal of the hats to and from the machine. 5th, The slide, fitted to the angular plate opposite the feeding dog, with its face recessed behind the general surface of the plate, and having applied to it a spring by which it is operated, in combination with the feeding dog. 6th, The plate, 26, and its lips, in combination with the plate, F.

166. Portable Capstan and Crabs; Asahel Elmer, Assignor to Nathan Elmer and R. M. Pritchard, Shabbona Grove, Illinois.

Claim—So combining with the truck wheels or ground supports a capstan and crab, and a flexible rigging, as that the power of the team that draws the apparatus and works the capstan may be used for setting or anchoring the said crab and capstan, as well as to raise it up, reload it on to the truck, and transport it from place to place.

167. Bomb Lances; Isaac Goodspeed, Norwich, Connecticut, Assignor to self and Geo. A. Mansfield, Boston, Massachusetts.

Claim—1st, The compound wing described, consisting of the wing proper, the lever, and the pin and slot, arranged as set forth. 2d, The construction of a projectile having a prismatic shank with guiding wings of copper, or any thin substance, fixed to the exterior surfaces of the prism in such a manner as to expand in coincident plates.

168. Railroad Station Indicator; Louis Koch, Assignor to self and H. Forstrick, City of New York.

Claim—The apron or band, with the names of the streets or stations on the line of the route marked thereon, attached to and working on rollers or a revolving plate, or stationary plate and revolving index, when said apron, plate, or index are operated from the running gear of the car by suitable mechanism to give the same a continuous movement, and simultaneous with that of the car.

169. Double Clasp-hook for Watch-chains, &c.; Morris Pollak, Assignor to Morris Talkenan, Morris Pollak, and Solomon Weiner, Hoboken, New Jersey.

Claim—The S-shape or double clasp hook, formed by the discs and clasp-jaws on the centre pin that passes through the middle of the bent piece.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Joule's Unit Verified. By J. P. Espy.

If we imagine an air-tight piston to move without friction in a cylinder 780 feet long, containing 780 cubic feet of air, at the temperature of zero, of half atmospheric density, to be condensed into half the space by a force of $7 \cdot 5 \times 144$ lbs., falling 390 feet, that is, through half the length of the cylinder, the air, by my experiments with the

double nephelescope, will be heated 76°. As this is effected by a weight of $7{\cdot}5 \times 144$ lbs., falling 390 feet, and as the air heated weighs 31·25 lbs., it may be used to test Joule's unit.

$7{\cdot}5 \times 144 \times 390$ is equal to the mechanical power of 421,200, which heats 31·25 lbs. 76°; therefore, to heat one pound will require $\frac{421,200}{31{\cdot}25} = 13,478$, and 13,478 being divided by 76° gives 177·3 the number of feet which one pound must fall to heat a pound of air one degree, and from this unit of mechanical power for air, any one of the elements may be corrected, Joule's unit, for instance, if the specific caloric of air is accurately ascertained: or, if Joule's unit is correctly ascertained, then the specific caloric of air will be known, being divided by Joule's unit, 772 gives 17·42 the number of degrees one pound of water would be heated, and also the number of degrees one pound of air would be heated if air had the same specific caloric as water; but as the specific caloric of bodies is inversely as their power of being heated, divide 17·42 by 76° it will give 0·229 the specific caloric of air. Now, as my experiments with the double nephelescope give the specific caloric of air 0·218 and Regnault's 0·23, and as Joule's unit brings out an intermediate number, Joule's unit is probably correct, and certainly cannot be altered, till some of the elements from which I have confirmed it are altered by more careful experiments, or by more careful calculations from the same elements. I have never seen how Joule experimented in obtaining his unit, but it will be gratifying to that gentleman to learn that his result is confirmed in so simple a manner by my experiments, as it certainly is gratifying to me, to find that my law of cooling by the expansion of air is in perfect harmony with his most beautiful principle. I have not M. Regnault's determination of the specific caloric of air before me; but according to my recollection it is between 0·23 and 0·24, and my experiments with the double nephelescope make it 0·218. If we assume Joule's unit as accurate, using that as an element the specific caloric of air is exactly 0·229.

It follows also from Joule's principle that we may easily find the temperature of air condensed into double, treble, &c., densities, if we take Regnault's authority for granted, that the specific caloric of air is the same at all densities and temperatures.

For if we suppose a cylinder of air at half density with a temperature of zero condensed by pressure into half the space, it will be heated by the process 76°, and if it is condensed into one-fourth the space, it will require twice the force moving through one-and-a-half times the space, and will thus produce an increase of temperature of $3 \times 76°$; it will require four times the force moving through one and three-fourths the space if it is condensed into one-eighth the space, and that is $7 \times 76°$, the next duplication will increase the temperature to $15 \times 76°$, the next to $31 \times 76°$, and so that at the distance of 35 miles below the surface of the earth the air by its own pressure, supposing it doubled its density every three and a half miles, would be 1024 times as dense as at the surface of the earth, and 153,748° hot.

This calculation is made on the supposition that Regnault's experiments have proved that the specific caloric of air is the same for all temperatures and densities. According to my experiments with the double nephelescope, the specific caloric of air diminishes as the density increases; a double density giving $6\frac{1}{2}$ per cent. less specific caloric, the heat, therefore, if my experiments are correct, is much greater than the estimate above. Certain it is, when double density was used, the cold of expansion into double space was 81°, whilst with common air the cold was only 76°.

The specific caloric of steam may also be calculated from the mechanical unit of heat. For as a column of air 780 feet long of one square foot area contains 62·5 lbs. in weight, the quantity of steam in pounds which is contained in an equal column can be calculated by taking $\frac{5}{8}$ of its weight, and diminishing that quantity in proportion to its temperature above zero. For example: at $\frac{1}{2}$ density the column of air at zero of the above size weighs 31·25 lbs., $\frac{5}{8}$ of which is 19·54 lbs., and this diminished by $\frac{180}{628}$ of the whole is 13·95 lbs., which a column of steam at $\frac{1}{2}$ atmospheric pressure and 180 in temperature weighs.

Now, if the area of the end of the cylinder, 144 inches, is multiplied by 7·5 lbs., which must fall 390 feet to produce double density in the steam, and thus raise its temperature 32°, it will make 10,880, and this multiplied by 390 makes 424,320, and this power heats 13·94 lbs. of steam 32°; consequently, $\frac{424320}{13 \cdot 94}$ will be required to heat one pound 32°, but if this last number, $\frac{424320}{13 \cdot 94}$, be divided by Joule's unit, 772, it will give the number of degrees a pound of water would be heated by the process 39·255°, and as the specific caloric of bodies is inversely as their powers of being heated, if 39·255° be divided by 32°, it will give 1·223 the specific caloric of steam at atmospheric pressure and 212° temperature.

In like manner I have calculated the specific caloric of steam for the several densities and temperatures below.

The first column contains the pressures in atmospheres; the second the temperatures; the third, the number of pounds of steam in the column to be heated by the condensation; the fourth, the mechanical power required to produce the condensation; the fifth and last, the specific caloric of steam at the different densities.

Atmospheres.	Temperatures.	Pounds of steam heated.	Mechanical power.	Specific caloric.
$\frac{1}{2}$ to 1	212°	13·95	421,200	1·223
1 to 2	248·5°	26·52	842,400	1·067
2 to 4	293·4°	50·23	1,684,800	0·965
4 to 8	343·6°	94·40	3,369,600	0·916
inches.				
0·2 to 0·4	52°	0·2427	11,232	1·50

From this table, unless there is some miscalculation, it appears that the specific caloric of steam diminishes as the density increases, as that of air does.

There is in fact a diminution of 25 per cent. from one atmosphere

to eight in density or rather in tension, for with eight times the tension the density is only about 6·7 times greater.

It appears also from the principle in question that in condensing air the higher the initial temperature the greater will be the heat produced by condensation—so that if air should be used at 448° or 461°, according to Regnault, above zero, a condensation into half the space would heat it $2 \times 76°$, and so in proportion.

For the Journal of the Franklin Institute.

Japan; its Industry and Meteorology.

About two years ago, when the United States Steamship *Mississippi* was about to sail for China, the Chairman of our Committee on Meteorology, requested Mr. Joseph H. Warrington of the Engineer Corps on board that vessel, to transmit to the Institute any information on scientific or industrial subjects which he might obtain during his visit to the Asiatics. By a letter from Mr. Warrington, dated Simoda, Japan, March 16th, 1859, the committee have been placed in possession of the appended meteorological table, made from observations taken at that place by Townsend Harris, Esq., U. S. Consul-General. They are probably the first published observations of an American in that country.

The Report is preceded by a notice of the Japanese and their productions, from which we extract the following:

So much has been said of the capabilities of the Chinese, that I really expected to find them a very smart people, but I have been greatly disappointed; and except their shrewdness and cunning, I must say that they have not one redeeming quality, and are a disgusting people. Not so with the Japanese, they are a very intelligent race, and are vastly superior to the Chinese in every respect; they are very cleanly in their habits; never enter a house with their shoes on; and excel in every thing which they undertake. They make shot and shell—and when at Hakodadi I endeavored to get a hollow shot for the Institute, but could not. Their casting is perfect; I had several very fine specimens, but they were sent away with several other things in a mistake, and it is very doubtful if I ever obtain them again; one was a casting in copper of a stag, which is equal to any thing of the kind I have ever seen in any of our large establishments like Cornelius, Baker & Co., or Archer, Warner & Co. If we go to Nagasaki I will try to get some more—their lacquer ware has a world-wide reputation. I have endeavored to obtain a specimen of the liquid lacquer, but failed. They make very neat joints in all their work, and have succeeded very well in constructing one or two vessels of about 300 tons. Their money is principally silver and copper. The kobaug, valued at about seven dollars, is gold; the itzabu is silver, and is rectangular in shape; the half itzabu has some gold in it, I believe, although the specimen which I have looks more like being washed with a solution of copper than an alloy of gold and silver. The copper coins are cash, 1475 of which are worth one dollar; the itzabu is valued at about 33

cents. The late treaty fixes their value by this standard;—"silver money will be taken weight for weight, with a deduction of six per cent. for expense of re-coinage."

The Dutch government have constructed a large machine shop at Nagasaki, where the Japanese receive instruction in the fabrication and management of steam engines. The shop is well fitted up with good tools, and some of the work I have seen, done by one of the apprentices, would do credit to a journeyman in the States.

They are very great adepts in the art of casting; and I saw a small 12 lb. howitzer in the lathe, which was beautifully cast. They have a small steamer which they bought from the Dutch government, and which runs up to Yeddo; the apprentices take turns in going aboard the steamer; but they cannot stand the heat. The profession of engineering is held in very high esteem by all the people, and they pay more respect to an engineer than they do to any of the other officers. If any of us (our corps,) are introduced to one Japanese officer by another, he tells him that we are "officer machinist," and we are sure of the greatest courtesy.

Meteorological Observations made at the United States Consulate-General, Simoda, Japan. By Townsend Harris, Esq., U. S. C. G.

		Thermometer.				Winds.					Weather.			
Year.	Month.	Highest.	Lowest.	Mean.	Extreme daily range.	N. & E.	N. & W.	S. & E.	S. & W.	Calm.	Rain.	Showers.	Cloudy.	Fine.
1856.	October,	77	51	64·3	15	17	4	5	5	4	3	5	5	18
"	November,	69	46	57·4	14	12	4		9	5	2	1	2	25
"	December,	69	36	48·9	17		16	1	13	1		4		27
1857.	January,	54	33	45·1	15	75	20			4	2	1	3	25
"	February,	63	32	45·5	19	9	13		5	1	4	4	4	16
"	March,	63	38	51·6	13	11	6	3	7	4	5	4	2	20
"	April,	67	43	57·2	14	6	5	3	13	3	4	2	3	21
"	May,	73	55	64·1	11	15	3	2	9	2	11	2	6	12
"	June,	80	59	70·8	10	6	1	4	16	3	7	6	3	14
"	July,	84	66	76·1	7	5	2	1	21	2	5	5	3	18
"	August,	87	67	77·7	10	12			14	5	4	4		23
"	September	85	62	75·4	12	11	3		11	5	4	3	2	21
For 12 months.		87	32	61 17		107	77	19	123	39	51	41	33	240

Remarks.—The thermometer was noted at 8 A. M.; noon, 4 and 10 P. M.

Winds from the cardinal points are put back one point, *i. e.*, north is put down northerly and westerly, and south southerly and easterly, &c.

The *prevailing* wind of the day only is noted.

Warmest day, August 7th, mean 83·25°.

Coldest day, February 2d, mean 36·25°.

February 11th, 4 A. M, thermometer stood at 28°.

First white frost, December 12th.

Ice made on eight nights.

Snow fell twice.

Earthquakes, thirty-four, all light.

Only one severe gale of wind.

Thickest ice $1\frac{1}{4}$ inches.

Ice or snow melts before 2 P. M.

Warmest month, August, mean 77·7°.

Coldest month, January, mean 45·1°.

*On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure rapid and certain communication.** By S. ALFRED VARLEY, Assoc. Inst. C. E.

(Continued from page 206.)

Mr. CROMWELL VARLEY said he could answer some of the questions put by Professor Tyndall. He had consistently recommended to the Electric and International Telegraph Company the use of wires of large diameter, for the last twelve years, as the only means of obviating the difficulties experienced on long circuits in wet weather from leakage, which, with the earlier forms of insulator used, was very great. Since the introduction of submerged wires he had pointed out the advantage that would be gained in such circuits of great length by the use of copper wire of large sectional area. On his recommendation the directors of the above-named company had tried both of these experiments on a large scale. They had erected iron wires of No. 3 wire-gauge on the London and North Western Railway, on the Great Western, and the London and North Western Railways, instead of the usual size (No. 8.) The results were such that he had no doubt they would never again, for long circuits (viz: of over 200 miles in length), erect other than thick wires. They had tried thick wire under the sea in their new cable connecting England with Holland. This cable contained four conductors of No. 13 instead of No. 16 wire, and although, for reasons explained further on, the relative speed of this compared with that of the former size was not so great, yet there was a very decided gain in rapidity, together with much stronger and much more uniform and reliable currents. These wires were connected both in England and Holland with a considerable length of overground wire, which latter was much affected by changes of the weather, and the gain in unfavorable weather from using the larger wire was, as predicted, very considerable. He was very much surprised to find Mr. C. V. Walker adhering to, and supporting, views which other well-known electricians had put forward, viz: that increasing the sectional area of the wire did not increase the rapidity of the transmission of electric signals. The experiment, however, had been lately tried in the new Dutch cable, and although the relative speed was not exactly known because there were many difficulties in the way, yet the fact was established that increasing the sectional area had greatly increased the speed. He had tried to determine the effects of induction, &c., on the speed of the electric wave; not only had the inductive effect to be taken into consideration, but also the absorption of electricity by the surfaces of the dielectric, and these influences were ever changing by heat and by the charging of the wire to such an extent that approximate results only were obtainable, which, however, were sufficiently near for all practical purposes. The absorption of electricity by the surface of the dielectric required time, and therefore cables of such length and dimensions as would only work slowly, suffered more from this absorption than shorter and

* From the Jour. of the Society of Arts, No. 332.

quicker ones. The retardation of the wave in a cable was caused by the lateral induction absorbing part of the electricity intended to give the signal through the line, and until this charge approached the maximum the current at the distant end would be weak. If two cables were made, the one with an iron and the other with a copper conducting wire inside the gutta percha, all other things remaining the same, the former would have as much induction as the latter, because this had reference only to the surfaces of the dielectric. As the iron wire would only conduct at one-quarter the speed of the copper, it would require, with a given electro-motive force, four times as long to transmit a given current. The electricity would require, in the case of the iron wire cable, four times as long to charge the gutta percha, by lateral induction, as the copper wire would, consequently such a cable would have only one-quarter the speed of the other. Were it possible to compress twice as much copper into the same diameter, and so double the conducting power without increasing the inductive surfaces, the speed would be immediately doubled. This was not possible, and the effect could only be obtained by increasing the sectional area of the wire; increasing this four times, doubled the interior surface of the gutta percha, which was the chief inductive surface, and, leaving out of consideration for a moment the exterior surface, the conducting power would be quadrupled while the induction was only doubled; hence there would be a gain in speed of from 1 to 2. But there was more still than this gained; first, suppose the diameter of the small wire to be unity, and the thickness of the gutta percha covering also unity, the exterior surface of the gutta percha would be 3, and the combined surfaces of the gutta percha would be $3 + 1 = 4$. In the second case, where the copper wire was doubled in diameter, and quadrupled in weight, there would be two for the inner surface of the gutta percha, and four only for the outer surface, instead of six—collectively, six instead of eight. Hence doubling the diameter more than doubled the speed. The third gain from the large wire was, that, having a higher speed, there was less time for the absorption of electricity, and, consequently, the disturbance and retardation from this cause were less. Having a current of four times the power entering the cable, and the leakage being less in proportion to it, the current received at the distant end would be more than four times as powerful, and much more regular; the apparatus would be less frequently interrupted for adjustment, and would, consequently, work without intermission for a much longer period than the smaller wire. Mr. Walker had alluded to the Atlantic cable, and stated, in proof of the sufficiency of the diameter of the copper wire, the fact that a single element of water battery gave a current perceptible at the other end. He (Mr. Varley) contended that this proved nothing as to its ability to transmit intelligible signals. In an Atlantic cable we must have not only a wire capable of giving currents and signals, but of giving such currents and signals as should overcome the friction and inertia of the apparatus used for indicating them; these currents must be so powerful and constant, that, when the philosopher had left the cable to the ordinary manipu-

lator, the currents should not fluctuate so much as to interrupt the intelligibility of the communications. The current must have such force, that the varying friction of the apparatus should not materially influence the recording of signals. In the Atlantic experiment these difficulties were overcome to a great extent by a most ingenious little instrument—Professor Thompson's reflecting galvanometer. In this instrument the only friction was that of a single thread from a silk cocoon, supporting a very short magnetic needle, only $\frac{1}{3}$ of an inch in length, which carried a small mirror made so light as to weigh only a grain or two. The mirror reflected back through a lens a ray of light, and thus without impeding its free action, or adding to its friction, a long but imponderable arm was added to the needle to magnify its motion. This little needle was rendered more or less nearly astatic by placing a large magnet under it to neutralize the earth's magnetism, and thus a nearly astatic instrument, sufficiently rapid in action from its small dimensions, sufficiently sensitive by its long imponderable arm (or ray of light), sufficiently free from friction by being suspended from a filament of silk, was obtained, and by it the faint signals through the cable were rendered visible. These signals were watched by a clerk, and recorded by hand on a Bain's printing machine. He (Mr. Cromwell Varley) felt that sufficient credit had not been given to Professor Thompson for this instrument, without which the Atlantic cable would never have transmitted a single message, and the world would not have had this great experiment to guide them, as there would have been no means of ascertaining whether the cable had reached the bottom of the Atlantic without parting. Such an instrument, however, was not calculated to meet the requirements of a commercial undertaking, because the reflected spot of light was difficult to follow with the eye for any length of time, and was often recorded by the manipulator incorrectly. The current must have sufficient force to record itself. With regard to the insulating properties of gutta percha, when pure and free from moisture he had found it to rank among the best dielectrics, but this was not the condition of the gutta percha used on cables, which appeared to be porous and to contain moisture. When the gutta percha was sufficiently heated to free it from this, there was great danger of altering its character, and rendering it liable to become brittle and to crack. In the Atlantic cable, even before it had been put under water, the loss of current by leakage was so considerable that less than one-third of the original current only reached the distant end. Were the loss constant in quantity it would not so much matter, but wherever the current escaped through moisture, there was polarization and ever-varying resistance at the leaky spot. As an example, he would quote one of many similar cases that had come under his notice. In one of the London and Liverpool wires, there was a defect in the Kilsby tunnel, caused by a filament of wood in the gutta percha, which was wet at this spot. This leak gradually got worse and worse, and sometimes offered a resistance equal to ten miles of the line composing the circuit, and at other times, especially after the continuous passage of a positive current for some length of time, it offered a resistance

equal to more than a thousand miles of the circuit. The fault was situated nearly half way, roughly speaking, 100 miles from the end, and when it offered a resistance of only 10 miles, $\frac{1}{11}$ only of the current from London reached Liverpool, assuming the rest of the line perfectly insulated. When the fault from polarization, &c., offered 1000 miles resistance, the current which reached Liverpool was $\frac{10}{11}$ of that which left London; these fluctuations sometimes took place in a second of time. The formulæ for such a case was $e = \frac{\text{E}\,l}{l + y}$, where e was the current received at the distant end, E the current leaving the original station (London), l the resistance of the leak, and y the resistance of the line between the leak and the receiving station. Now in the former case, the current was amply powerful enough to work the instruments, and no inconvenience would have been experienced had the fault remained constant, but, on the contrary, it was always varying in force, and to such an extent that it was impossible to work the line though only 200 miles in length. Thus it would be seen that, leaving out of the question induction, and its consequent diminution of speed, a conductor of sufficient size must be had to cause these leaks to bear only a small proportion to the current transmitted, in order that the received signals might be sufficiently regular and equal in force to record themselves with certainty and ease. Unless these conditions were attended to, the cable, as a commercial undertaking, would inevitably fail. With regard to the rapidity of conduction of the electric current, his opinion was that the current began to flow from the distant end *immediately* after the near end was connected to the battery. Electricity showed no signs of compressibility or elasticity, and was without inertia. Suppose, for a moment, that a cable was divided into several portions, each of which was without appreciable resistance, but separated from the next portion by a given resistance, the first portion, on coming in contact with the battery, would be instantly charged, and as instantly would begin charging the next portion, but to a lower degree than itself; this second portion as instantly charged the third portion, to, of course, a still lower degree; and this the next, and so on to the end. By careful reasoning on the known laws of electricity he had come to the conclusion that the current began to flow out of the distant end instantly, but so feebly at first that the most delicate instruments failed to show it. Before concluding, he would draw attention to the unhappily chosen terms "quantity" and "intensity." What in England was generally understood by "quantity," was in Germany termed intensity or I. What in England was termed "intensity" or tension, was the electro-motive force; in other words, the $\text{I} = \frac{\text{E}}{\text{R}}$, where I represented the power of the current to decompose a given quantity of an electrolyte, E the electro-motive force of the current, and R the resistance of the circuit. These terms had unfortunately led many into error, more especially the word "intensity."

Mr. C. W. Siemens agreed with much that had been said in the paper. He was decidedly in favor of a large conductor of the very best specific conducting power; and had maintained from the first that the conductor of the Atlantic cable was totally inadequate. When he read a paper last year before this Society, he had expressed the laws by which the proportion of an electric cable should be regulated for a given length by a simple formula; and he thought that a mathematical expression properly explained was preferable to an explanation in words only, even for a popular assembly like the present, because it combined all the elements to be taken into consideration. He did not agree with Mr. Varley that an electric wave on entering a submerged cable at one end presented itself, in however slight a degree, instantaneously at the other. The laws of induction and conduction, as he understood them, were directly opposed to such an assumption; and in his own experience he had certainly never observed any indication of it. The line expressing the relative amount of charge at different points of the electric wave in the conductor, was expressed not by a dynamical curve, as Mr. Varley had shown it, but by a straight line, terminating abruptly upon the horizontal line which represented the conductor. Another portion of the paper dealt with the complete metallic circuit in submarine conductors, which it was generally understood had been first proposed by his (Mr. Siemens') brother. Mr. Siemens could not agree with the views expressed by Mr. Varley, and by several others who had lately written in the scientific journals upon this subject. Some of them seemed to lose sight entirely of the most essential condition, namely, that the two conductors were to be embedded in the same insulating medium. His brother had never for a moment assumed, as seemed to be supposed, that lateral induction between the two conductors constituting the circuit would be obviated. On the contrary, it would be rather increased on account of the greater resistance of the metallic circuit. But it was maintained that the charge between the conductors and the larger surface of the sheathing would be nearly entirely obviated; that the working of one metallic circuit in a multiple cable (which his brother had chiefly in view) would not disturb the electrical equilibrium of the other conductors; that the losses by leakage would be reduced, enabling him to reduce also the area of the conductor, and thereby also the lateral induction between them; that the metallic circuit was not affected by magnetic storms; and, finally, that considerable advantage could be obtained by the mutual acceleration of the positive and negative currents by Volta induction. So long as a single conductor could satisfy the public demand for messages, the advantages of a metallic return wire would probably not warrant the additional expense, but wherever several conductors became necessary, the advantage of working through metallic circuits would be very great. Mr. Varley's illustration of surrounding the one conductor by the other (in the form of a tube) did not meet the case, because the tubular conductor possessed the very condition which it was intended to avoid, namely, an extended inductive surface both against the inner conductor and the outer sheath-

ing. Mr. Siemens had only one other point to remark upon, and that was of an historical nature. Mr. Varley had stated that Mr. W. Siemens had first employed gutta percha coated wires in Prussia in 1850, where he had observed the phenomena of induction also. It was, however, in 1847 when the first gutta percha coated line wire was laid down successfully near Berlin; and he (Mr. Siemens) exhibited specimens of it, and explained the phenomena of charge which had been observed, before this Society in 1848. He might also observe that the statements which had been circulated, that the gutta percha coated wire, as first prepared in Prussia, had proved an entire failure, were very unfair towards his brother. These wires had been coated in the same manner as they were at the present day, although it must be admitted that the quality of the gutta percha employed was very inferior. These lines had, however, done good service for four or five years, when they began to fail; some of them had, however, lasted much longer, and some—covered with lead—were actually in use to the present day. He did not think that a much more favorable result had since been obtained elsewhere.

Mr. Leonard Wray said he would make but a few brief remarks upon some of the points under discussion. In the first place he considered that the paper read by Mr. Varley was a very valuable and instructive one, for which all present must feel indebted to him. Let the ideas brought before the Society that evening be designated as mere conjectures, or theories, or what not, still he ventured to differ from Professor Tyndall's opinion, that Mr. Varley should have confined them to his own breast until he had fully tested and proved them practically, inasmuch as Mr. Varley, by giving publicity to them before that Society had, in fact, laid them before the whole world of science, and the result would be, that instead of these ideas remaining stored up in his own mind alone, to be worked out solely by his own individual energies, there would now be many, very many, minds brought to bear upon them, and to assist in reducing them the more speedily to the test of practical experiment. The next point he would remark upon was the best diameter for the conductors of electric telegraph cables, a subject which was so very much discussed, and so very much disputed, that he would only present to the notice of the Society one very singular and significant fact bearing upon the question. When telegraph wires were first introduced into India, Sir W. O'Shaughnessy and his staff were sadly annoyed by the continual breakings of their wires, caused by very large birds alighting upon them. To remedy this nuisance that gentleman employed very thick, strong wires which these birds could not injure; and this great increase in the size of the wires brought out the remarkable fact that no insulation whatever was necessary at the posts around which they were simply wound. This deserved, he thought, to be recorded in such a discussion as the present. The third and last subject to which he (Mr. Wray) would refer, was that of insulation. Now, the substance almost universally used as an insulating material was gutta percha; but they were told, and many of them knew it as a fact, that gutta percha

absorbed no inconsiderable quantity of electricity; indeed, that it became, to a certain extent, saturated with it. Such being the case, it must be evident that gutta percha was by no means a perfect insulator, for he held it as an axiom, that no really good and perfect insulator would absorb electricity. The greater the quantity of electricity absorbed by the insulating material used, the greater would be the retardation of the current. Hitherto, then, a substance had been employed which was very far from perfect, and all calculations had been based upon its known insulating properties; but if they had a superior —a very much more perfect insulating material—would it not be possible to construct cables with a far less quantity of that material than gutta percha? He thought so, and he moreover believed that such an insulating material as he had spoken of, would, very probably, be soon discovered.

Mr. S. Alfred Varley said he had but little to reply to, as no attempt had been made to refute the views he had brought forward. He was unable to follow Mr. C. V. Walker throughout, and he did not clearly see the direction in which his views tended. Mr. Walker appeared to object to the statement made, that there was a difference between an ordinary Leyden jar and a submarine circuit; yet he admitted that the conductor united the inner and outer coatings of a submarine wire when regarded as a Leyden arrangement, and that the resistance it opposed was the only thing which prevented the free flow from the one to the other; now he (Mr. Varley) thought this was a most important admission, for upon it depended the reason why a large wire conducted more rapidly than a smaller one, and this was no longer a theory, but an ascertained fact. If there were no difference between a submarine wire and an ordinary Leyden jar, and if a submarine circuit had to be charged statically to saturation before signals passed, as was stated to be the case by the advocates of the small wire system, then it would be clear that as the greater the sectional area, the larger the Leyden arrangement would be, there would be more retardations with larger conductors, as more electricity would be required to charge them. He maintained that, in practice, a submarine circuit was not charged to saturation; the degree to which it was charged statically depended upon the relative balance between the conditions which favored induction and conduction; if the conditions, as had been stated in the paper, favored conduction, there would be less statical charge, and a greater proportion of the electrical impulse would be directed forward, and signals would be obtained more quickly. He fully concurred in all the views expressed by Professor Tyndall, and quite agreed with him as to the desirableness of searching for facts with actual submarine circuits of varying dimensions; but when these were not at command, he thought we should not wait for such favorable conditions for experimenting, but should endeavor to obtain the best substitute we could. Moreover, if it were possible to obtain all the conditions which submarine circuits presented in our own private laboratories, this would be a positive advantage, for the whole being under immediate command, and not disturbed in any way by

atmospheric causes, more or less defective insulation, or other disturbing influences always occurring more or less in practice, we should be enabled to trace out principles more clearly and have fewer sources of error to eliminate. Mr. Siemens, when considering the question of the complete metallic circuit *versus* the earth for one-half of it, objected to the fairness of the diagram in which one of the conductors was made into a tube. This diagram was introduced, as was stated in the paper, as an exaggeration, simply to show the fallacy of the principle; and although, as was stated by Mr. Siemens, the wires would not, when side by side, present as much surface to induction as an ordinary circuit, yet it must be borne in mind that there would be just twice the resistance of that which would be opposed when the earth was employed for one-half of the circuit, and this would more than counterbalance the lessened surface exposed to induction. He agreed generally with the remarks made by Mr. Wray. There was no doubt that with large conductors imperfect insulation was less felt, but the result in Sir W. O'Shaughnessy's case was probably not altogether due to the size of the conductor, for it must be remembered that the climate was very hot and dry. As a practical fact, he (Mr. Varley) would state that when in the Crimea they never obtained what telegraphists termed a "perfect earth." In the submarine circuit between Varna and Constantinople, contact with the earth was made by connecting a wire to the iron sheathing of a piece of the cable, more than a quarter of a mile in length, which was buried in the earth, and passed through the British Embassy grounds, yet, notwithstanding this extensive surface, in hot weather he found the earth, to use a telegraphic expression, very far from "perfect," and he remedied this by carrying a wire out into the Bosphorus.

The CHAIRMAN said, before proposing the usual vote of thanks, he would express his opinion of the result of the discussion that evening. They had advanced very little in practical knowledge since the failure of last year with the Atlantic cable; but the proper way of doing so was to follow the course pointed out by Professor Tyndall. At the same time he thought it was well that theories should be advanced with a view to set men thinking; but the professor no doubt meant to pay Mr. Varley the compliment that his knowledge of this matter would be better applied to the practice than the theory of the subject. But Mr. Varley was, in fact, doing what had been asked of him; and it was only owing to some delay in the completion of an elaborate instrument that he was not able to lay before them the results of actual experiment. The *experimentum crucis* was what they really wanted; wires of different conducting powers tested against each other, and the results ascertained by the best class of instruments, and, he would add, by a variety of experimenters. He found that electricians still remained true to their colors, in the absence of positive results one way or the other. His friend Mr. Walker still adhered to the small wire, whilst others appeared as the consistent advocates of a large wire as the best conducting medium. In this country, such opportunities were presented for experiment upon a large scale, that they

had nothing to fear from theory; and he hoped such experiments would be made as would solve many of the points upon which so much diversity of opinion now prevailed. He would now propose a vote of thanks to Mr. Varley for his able and interesting paper.

For the Journal of the Franklin Institute.

Particulars and Performance of the U. S. Steamer Wyoming.

The above named steam sloop, the first finished of seven ordered to be built by Congress in 1857–'58, returned on the 6th of Sept., 1859, from a trial trip of two weeks duration, of which one week was passed at Charleston, to which port she went by order of the Honorable Secretary of the Navy.

The *Wyoming's* hull was constructed at the Philadelphia Navy Yard, under the supervision of Francis Grice, Esq., by whom she was designed.

It has the following dimensions, viz:—

Hull.—

Length, billet to taffrail,	232 feet 9 inches.
" on gun deck,	209 " 9 "
" between perpendiculars,	198 " 6 "
" of keel from back part of forward stern post,	188 "
Width of beam molded,	32 " 2 "
" " extreme,	33 "
Depth of hold,	15 " 10 "
" forward and aft of machinery space of lower hold under berth deck,	8 " 10 "
Space allotted to machinery, comprised between two wooden water-tight bulkheads,	50 " 8 "
Draft of water loaded, forward,	12 " 7 "
" " aft,	13 " 2 "
Displacement, 1475 tons.	
Area of immersed midship section, 391 sq. feet.	
Tonnage (custom-house measurement), 997 tons.	

Carries three months provisions, six months stores.

Spars and Sails.—Barque rig.—

Foremast above deck,	54 feet.
Main mast "	59 "
Mizen " "	53 "
Fore and main topmast,	36 "
Mizen "	35 "
Bowsprit outboard,	26. "
Jibboom,	25 "
Spanker boom,	50 "
Area of sails, 9705 sq. feet.	

Armament.—

2 11-inch pivot guns and carriages.
4 32-inch guns " "

Weight of guns in all,	40 tons.
" ammunition for guns,	30 "

The machinery was designed and constructed by Messrs. Merrick

& Sons, of Philadelphia. The requirements of the Navy Department for the vessels of this class were stringent, and calculated to draw out the best talent of the country in their execution. The result of the trial of this ship shows that Mr. Toucey's efforts to increase the efficiency and economy of the United States Navy, have been effectual.

The guarantees required of the contractors for this and the other vessels of the same class, were briefly as follows:—

1st, That the weight of all the machinery, spares, tools, water in the boilers, and coal for five days maximum steaming, should not exceed 406 tons (of 2240 pounds).

2d, That the engines should be capable of making 80 turns per minute.

3d, That the machinery should be capable of developing 1000 horse power by indicator.

4th, That the consumption of coal per indicated horse power per hour, should not exceed a certain rate (in the case of the *Wyoming* 2·9 pounds).

All the ships were to be provided with a surface condenser.

The principal dimensions of the machinery for this ship are given below.

ENGINES.—Two horizontal double piston rod, direct-acting engines.—

Cylinders, diameter,		4 feet	2 inches.
" stroke of piston,		2 "	6 "
Crank shaft, diameter,			11½ "
Shafting, "			10 "
Fresh water air-pumps (two) diameter, each,			11 "
" " stroke,		2 "	6 "
Salt water circulating pumps (two) diameter,			10 "
" " " stroke,		2 "	6 "
Condenser—surface,	3000 sq. ft.		
Number of tubes (brass),	3000.		
Diameter "			0⅝ "
Length "		6 "	

Having its tubes secured at both ends in tube sheets, one of which is fast, the other free to move with the expansion of the tubes.

The engines have slide valves, and independent cut-off valves sliding within and upon them, which may be adjusted at pleasure, while in motion, to cut off between 6 and 21 inches from commencement of stroke. They are driven by links from the cross-heads.

The crank shaft bearings are four in number: the after one 24 ins. long, the two middle ones 18 inches each, and the forward one 16 ins. They are in four pieces each, chambered to allow of the passage of water around without touching the wearing surfaces. Each piece, or all, may be removed without moving the crank shaft. The upper and lower pieces are not keyed up, but simply slipped, when raised or lowered to overcome the wear. The cap-bolts being horizontal, take the direct strain. The eccentrics and link motions are between the engines.

The propeller shaft is covered with brass where it passes through the deadwood, and revolves in lignum-vitæ bearing bushes, 7 feet 6 inches in total length.

The thrust is taken either on spherical steel rollers, or on the usual collar thrust, as may be preferred.

The engines drive the line of shafting by a clutch coupling having four steel faces. This may be disengaged in a moment when the ship is put under sail alone.

Space occupied by engines in length of ship, including passage ways 19 inches wide, both forward and aft,		15 feet 11 inches.

BOILERS.—Three of Martin's vertical tubular, having iron shells and brass tubes, placed two on one side of the ship (of which one consists of a single furnace, and is used as an auxiliary or "donkey"), and one on the other side, facing each other, with a fore and aft fire-room between them.

Length occupied in the ship,		24 feet 9 inches.
Breadth, " " including fire-room,		29 "
Depth, exclusive of steam drum,		10 " 2 "
" inclusive " 10 feet diameter,		14 " 2 "
Fire-room, length,		24 " 9 "
" breadth,		8 " 6 "
Surface in all boilers,	7890 sq. ft.	
Tubes, number "	4280.	
" length,		2 " 7¼ "
" external diameter,		2 "
Grates, number,	14.	
" breadth (except of donkey, which is 2 feet 6 ins.),		3 "
" length,		5 " 10 "
" area,	242 sq. ft.	
Smoke-pipe—one telescopic in two sections.		
" height, when up, above deck,		40 "
" " " grate,		52 "
" diameter,		6 " 10 "
" area,	36·7 sq. ft.	
Least area between tubes in all boilers,	39·65 "	

PROPELLER.—One brass true screw.—

Number of blades,	4.	
Diameter of screw,		12 feet 3 inches.
Pitch "		19 "
Length "		2 " 6 "
Weight of all machinery, spares, &c., and water in the boilers,	227·6 tons.	

COAL BUNKERS—Extending over the boilers, partly over the engines, and between the boilers and engines, leaving only a passage way, in which are placed the hand pump and donkey pump.

CONTENTS—163 tons anthracite—also, forward of the machinery space is an extra bunk carrying 72 tons—making 235 tons in all.

Performance.

The following is an abstract of each half day's performance during the trip out to Charleston and back. On the outward passage the engines were run at easy speed. That passage, from the Capes of the Delaware to Charleston bar, was made against a head wind and moderate head sea, in 59 hours 40 minutes running time; average speed by Massey's patent log, 9·3 knots per hour the whole distance. On the homeward passage the wind was favorable, but light, for 24 hours; the rest of the time ahead, increasing to a moderate gale for the last 10 hours before reaching the Capes. Time, 46 hours 45 minutes from the Bar to Capes of the Delaware; average speed 10·8 knots. Highest speed under steam alone for one hour, 11·5 knots. Highest for six consecutive hours, 11 knots.

Outward Trip.

Hours.		Revols. per minute.	Steam pounds.	Vacuum inches.	Cut-off inches.	Throttle, per cent. open.	Indicated horse power.	Temp. feed water.	Saturati'n in boilers, 1-32 unity.	Coal per hour.	Coal per H. P. per hour.	
Aug. 25,	11	45·3	15·81	22·45	13·3	·25	302·3	83°	0·00	1089	3·60	Mod. head sea.
" 26,	12	54·0	14·58	23·30	14·3	·29	370·4	84°	0·00	1280	3·45	" " wind & sea.
	12	63·4	16·10	23·50	9·0	·74	503·1	90°	0·25	1415	2·81	" head swell lig't H.S.
" 27,	12	63·0	17·60	23·70	8·5	·62	466·8	87°	0 62	1514	3·21	" " sea fresh H.a.
	12	64·1	16·85	23·46	8·5	·79	504·8	89°	0·93	1560	3 09	" " "
" 28,	1	66·6	17·00	23·00	8·5	·80	568·7	88°	1·12	1500	2·60	" " "
Mean.		58·2	16 20	23·29	10·62	·60	433·9	86°	0·37	1378	3·17	
						Homeward Trip.						
Sept. 3,	10	69·0	17·50	22·33	10·45	·85	619·0	86°	0·80	1740	2·81	Fresh B. star'd. beam.
" 4,	12	71·7	17·42	22·90	11·25	1·00	709·3	89°	1·00	1680	2·37	Sail set, very light B.
	12	73·3	17·33	22·00	10·04	·77	621,7	86°	1·06	1780	3·02	" "
" 5,	12	69·8	17·25	20·50	10 60	·75	581·5	88°	1·12	1820	3 09	Light B ahead,increas'g to head wind & sea.
	12	72·5	14·83	20·50	11·50	1·00	618·7	83°	1·20	1710	2·77	Delaware Bay and
" 6,	2	74·5	18·25	23·50	11 50	1·00	793·0	90°	1·18	1760	2·22	River.
Means.		71·45	16·90	21·68	10·78	·88	637·8	86°	1·05	1746	2·73	

Pounds of coal used in outward trip, including passage down the Delaware river, of which, log is not given here, being broken by stoppages, was, ...	111,140
Pounds of ashes thrown overboard in all was, .	21,741
Per centage of ashes to coal, . . 19½ per cent.	
Pounds of coal used in homeward trip, . .	121,240
" ashes " " . .	21,765
Per centage of ashes to coal, . . . 18 per cent.	

The coal and ashes were both carefully weighed.

In the table the mean horse power exerted was found in the following manner. A large number of diagrams were taken during the trip under different conditions of throttle, cut-off, pressure and vacuum. Each diagram was calculated and the mean pressure found. The *theoretical* mean pressure due to the boiler pressure, back pressure in condenser, and point of cut-off was then calculated, and the ratio found between the two mean pressures. By classifying these ratios for different conditions of throttle, considerable uniformity was observed to exist in the results; the actual mean pressures were as follows:

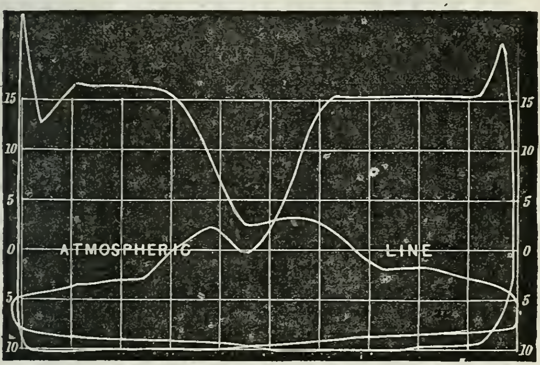
With throttle	¼	open	0·52	of the theoretical	M. P.
"	½	"	0·64	"	"
"	⅝	"	0·72	"	"
"	¾	"	0·75	"	"
"	⅞	"	0·78	"	"
"	wide		0·80	"	"

For each hour, the boiler and condenser pressures, cut-off, and throttle being noted, the actual mean pressure and horse power were found by application of the proper ratio, and of those indicated horse powers the mean was inserted in the proper column. It is certain that the results must be substantially correct, and if any corroboration were

needed it may be found in the diagram given below, which was taken under conditions about the same as the average of the homeward trip, and the H. P. was for this diagram 315·36, and for that of the after engine at the same time 325·44, giving for both 640·8 H. P., or within 3 H. P. of the mean exerted by the table.

INDICATOR DIAGRAM, forward engine, taken Sept. 3d, 6·5 A. M.

Cut-off—10·5 inches.	Vacuum gauge—$21\frac{1}{2}$ inches.
Revolutions per minute—72.	Temperature hot-well—86° F.
Pressure of steam in boilers—18 lbs.	Mean pressure—14·75 lbs.
Throttle valve wide open.	Coal per H. P.—2·80 lbs.



During the whole trip only 13 (out of 14) furnaces were in use. The greatest number of revolutions made was $79\frac{6}{10}$ per minute for one hour. The highest for any four consecutive hours was $74\frac{4}{10}$.

The average consumption of coal for 638 H. P. was $18\frac{3}{4}$ tons per 24 hours. At the same rate to make 1000 H. P. would require $29\frac{1}{3}$ tons. The engine bunkers therefore hold $5\frac{1}{2}$ days coal at maximum steaming, and the extra bunk $2\frac{1}{2}$ days more; giving the ship an average speed at sea of 12·528 knots, if the speeds are as the cube roots of the powers. In other words, at this maximum speed, 1 ton of coal drives the ship $\frac{12{\cdot}528 \times 24}{29{\cdot}33} = 10{\cdot}25$ knots distance, and the bunkers afford a supply of coal to perform 2410 geographical miles. At the speed averaged, and which can be readily maintained, of 10·8 knots per hour, one ton of coal drives the ship $\frac{10{\cdot}8 \times 24}{18{\cdot}75} = 13{\cdot}8$ knots distance, and the bunkers hold coal for 3240 geographical miles.

The coal burnt during the trial was Blackheath, an anthracite of qualities not favorable for pushing, being by no means a free burning

coal, and requiring a strong draft for its combustion. And although free from clinker, the ashes formed a very large per centage, 19 per cent.

It was on this account only that the machinery developed on the trial trip less power than its capacity, the coal consumed being 1746 pounds per hour on 228 feet grate, or 7⅔ pounds per sq. foot per hour.

The machinery worked with great smoothness and regularity, no trouble whatever having been experienced from hot journals during the trip.

The boilers were not blown at all to reduce saturation. The slight increase of saturation towards the end of the trip was caused by the salt water added to make up for leakages around stuffing-boxes, &c. To the latter cause is due the reduced vacuum during a part of the homeward trip, and until an opportunity was afforded in the Delaware river to put in fresh packing.

It should have been stated that the steam is condensed within the tubes of the condenser, and that the salt water is forced to circulate between and around them in a direction contrary to that taken by the steam.

To the Editor of the Journal of the Franklin Institute.

SIR:—In the *American Railway Times* of September 10th, appears an article entitled "Experiments on the Strength of several kinds of Building Stones," stated to have been "read before the American Institute of Architects, by Robert G. Hatfield, Esq.," but the Editor omitted to add "copied verbatim from the *Journal of the Franklin Institute* for March, 1858."—(See *Journal*, vol. 35, p. 158.)

For the Journal of the Franklin Institute.

Atmospheric Electricity. By JAMES P. ESPY.

It has not yet been ascertained by electricians, so far as I know, what is the cause of atmospheric electricity; those, however, who have studied my theory of storms and agree with me that there is an upmoving current of air in the centre of all storms, kept up by constant evolution of latent caloric, as the vapor condenses by the cold of diminished pressure as the air ascends with its vapor in it, will agree with me that it follows as a corollary from the following experiments, that *electricity must be generated simply by the upmoving current of air from the surface of the earth*, especially if it be violent enough, as it frequently is, to carry up drops of rain with it to a great height.

It is well known that all bodies, as Dr. Alex. Palagi of Bologne says, in their natural state give signs of positive electricity, when separating from the soil, and of negative, when approaching it. In the 23rd volume of Geneva Archives of Science, pp. 286 and 382, it is stated that Volpicelli caused a ball of metal to revolve on a horizontal axis of

glass, at a distance from that axis one metre and a half, and connected by means of a copper ribbon with a Volta's condenser—during a demi-revolution ascending, detaching it when descending—and in four demi-revolutions, he collected positive electricity enough to make the straws diverge so as to touch the interior sides of the electrometer.

When the connexion was made with the ball descending, negative electricity was obtained.

Now, in all storms, especially where floods of rain descend, there are at the sides and under those parts of the cloud where floods of rain descend, down-moving currents of air, and this will account for the sudden change of electricity from positive to negative so well known to all observers. Moreover, as there are thousands of up-moving currents of air every day nearly all over the earth, this theory will account for the upper air being almost always positively electrified, for a body cannot be removed upwards from the surface of the earth without becoming positively electrified, and, vice versa, a body cannot descend towards the surface without becoming negatively electrified. It would be well to examine the electric state of the air in the belts of high barometer, where the air must in general be descending, and also in the *annulus* of storms, where the barometer stands above the mean, and of course the air must be descending there, to see if the electricity is not sometimes negative, and, if so, electricity may become a means of predicting storms.

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*On Embroidery by Machinery.** By George Wallis.

(Continued from page 189.)

The original machine, as devised by M. Heilmann, was worked by one person, but had this feature been retained the economic value of the invention would have been lessened. It was only by extending the size and capabilities, improving the structure of the parts, without in any way interfering with the principle, which has always been the same, that it could be brought into successful operation as a paying manufacturing agent. In Switzerland the original form is still retained for cotton embroidery, and found to answer for that class of work.

From the time of its first introduction into England, until within the last two or three years, the embroidering machine was employed only by Messrs. James Houldsworth & Co., of Manchester, as the successors of Mr. Louis Schwabe. A few machines are now used by one or two other persons at Manchester, but the great mass of productions in machine embroidery still emanate from the original proprietors, who have some twenty machines, more or less actively employed.

After the death of Mr. Louis Schwabe, in 1845, these machines were gradually brought to bear upon ladies' dresses, and during 1847 and 1848, at which period I was actively engaged with my friends,

* From the Jour. of the Society of Arts, No. 333.

the Messrs. Houldsworth, in the development of the capabilities of the machines in this direction, it is not too much to say that the productions of this house, by mechanical means only, did much to foster and keep up the demand for embroidery; and so far from interfering with the hand labor, it is a fact that, in 1849, there were in London alone some 2000 persons obtaining their living by embroidery who had never done so before, and in Scotland and the north of Ireland some thousands of females were employed in this industry, not in large factories, but in their own houses. The patterns were printed in outline upon the merino or other fabric to be embroidered. These were distributed by traveling agents, and were afterwards collected by them from the workers after the embroidery was finished. As is now generally known, this is the method pursued in Scotland and the north of Ireland in the production of sewed muslins and tambour work.

The advantages of the embroidery machine over hand labor lie chiefly in two points.

1. The rapidity, accuracy, and excellence of work in the production of repetitions of the design in borders, sprigs, flounces, and trimmings for dresses.

2. The perfect embroidery of a pattern on each side of the fabric, as in the case of window curtains, table covers, and trimmings for upholstery purposes.

In the first of these it will be seen that, inasmuch as a needle can be worked at every inch and a half of a machine, and in a double row, there must be great economy in the execution of a pattern arranged so as to repeat at every inch and a half within the vertical range of the embroidering frame, that is to say, within the action of the pantagraph in its command over the rows of needles. The machine is therefore always worked at the greatest advantage when the full range of needles is brought into operation by small repeats, and at the greatest disadvantage when large repeats are worked, and thus a certain number of needles, or rather needle-holders or pincers, are idle. Thus in a pattern which is only repeated at every six inches, three pincers would be idle in every such space in the machine; and my own impression is, that with less than a dozen needles at work, the machine operates at a loss, or at least that there is no gain in the work, except in the matter of a double-sided pattern. The usual calculation is that with less than eight needles the work is executed at a loss.

This is, of course, one of the disadvantages of the machine in certain classes of the work; and except under certain peculiar arrangements of the design, there was always great difficulty in competing with hand labor, in the execution of the "collonade" fronts of ladies dresses at the period these were in fashion. On the contrary, in bordered and flounced dresses, hand labor had no chance with the machine.

As may be supposed, these machines presented an apparently insurmountable obstacle in the execution of a series of repeats in a curved line, which a few years ago was one of the problems yet to be solved. Mr. James Houldsworth, the present proprietor, however, has

overcome this difficulty in suitable fabrics, by constructing an embroidering frame for insertion into the machine, on which the fabric being stretched upon elastic cross pieces, and screwed up to the desired curvature, the design is embroidered in a right line, but when the fabric regains its original position on removal from the frame, this line becomes a curve, the reverse of the direction in which it was stretched.

Embroidery for dresses being comparatively out of fashion, the machines are chiefly used at the present time for furniture fabrics, such as window curtains, table covers, valences, borderings, and goods for foreign markets, of which there are before you some admirable specimens, all produced by Messrs. James Houldsworth & Co., of Manchester.

Some of the capabilities of the embroidering machine are shown in these examples. The work is clear, fine, and according to the character of the design, perfect in all its parts; whilst the advantage of having the pattern complete on both sides of the fabric must be apparent to every one, especially in table covers and window curtain borders. Here the peculiar action of the machine in driving the needles through at a perfect right angle, and returning them at the same angle, becomes of great value; not, after all, that the two sides are equally perfect, yet no unpractised eye would easily detect the difference. When, however, the hand embroiderer attempts this kind of effect, the amount of attention required to execute the work, with even a moderate degree of precision, renders the operation any thing but an economical one.

An example of work, as applied to linen and cotton fabrics, not previously attempted in these machines, has reached me to-day. When the operation is perfected by the necessary experience, the result will no doubt be satisfactory, as the style of embroidery is well adapted to a great variety of articles in ladies' dress.

In the matter of design as applied to machine embroidery, it must be evident that there are certain peculiarities about it which the artist, to be successful, must thoroughly understand.

The repeats of the pattern must all be either one inch and a half wide, or multiples of that width; that is to say, three, four and a half or six inches, and so on. The vertical range may be said to be unlimited, except by economy of production; for by means of the rollers on which the fabric is placed, the work can be carried even into stripes, as indeed, has been done when necessary. In making a working design, the length of stitch has to be carefully kept in view, and the angle at which the thread will lie when the work is seen as a whole. In hand embroidery this is also a condition, but in that great masses of these stitches may be brought together, which is a peculiarity of Eastern embroidery, and the effect produced by the contrasting angles at which the thread is inserted is often very remarkable, especially when different shades of the same tint or color have been employed. In machine embroidery this kind of effect cannot be imitated successfully or economically, and it is usual to keep each form

as much as possible to one, or, at most, two series of stitches. Shaded effects, however, are produced, as in the case of the dress embroidered for Her Majesty, the Queen, by dyeing the silk with a graduated tint or shade, by which the thread is dark at one end and gradually becomes light at the other end. Pleasing effects are thus produced in a very economical manner, even in what are called self-colored embroideries —say, on dark green merino, embroidered with silk shaded from dark to light green. These irregular effects of light and shadow are not, however, very legitimate when viewed artistically; but for this the manufacturer cares quite as little as the consumer. If the thing sells with the one, and "looks pretty" to the other, that is enough according to the art-creed of both.

There is yet another point which in the smaller patterns it is of considerable importance for the designer to bear in mind. Silk at 40s. per pound is too costly to be wasted, therefore it is desirable that each needleful should do its work, and that no fragments should remain to cut away at a loss. Hence patterns have to be designed to the needleful; and, if a pattern, however excellent in the abstract it may be, consumed one needleful and 36 inches out of two needlefuls of 42 inches each, it would be considered any thing but sound economy in machine embroidery to execute it, as eight inches of silk would be lost in each needle employed—a waste upon any extent of production which would astonish those who are not in the habit of thinking about mere fragments in the materials of manufacture. It will at once be seen from this fact that the designs for machine embroidery must ever be somewhat peculiar, and, to a certain extent, limited in range of form, and that all the more successful—certainly the most economical—are made almost in the presence of the machine by which they are to be executed, and, for the most part, under no higher inspiration than that of a species of artistic measure table, such as:—

Two needlefuls make one flower.
Three flowers make one repeat.
Twenty repeats make one border.
Four borders make one table cover decoration.

One can thus tell almost to an inch—certainly to a yard—how much silk will be consumed in a given operation.

It will now be asked, "Do these machines begin and finish their work completely?" Not absolutely; but so perfect is the work in a well-arranged pattern that, with the exception of the cutting out of certain ends used for starting points, the occasional fastening of other ends, and the insertion here and there of a stitch by hand, the work is practically finished when it leaves the machine. Experienced hand embroiderers, acquainted with the peculiarities of machine work, are, however, employed to look it over.

As a branch of factory labor for females, none is so healthy, certainly none more interesting.

The workers are generally the most intelligent of their class, and their wages are fully remunerative when work is abundant; but there is one great drawback in the economical working of these machines,

in contradistinction to that of most other manufacturing agents. The fashion for embroidery fluctuates very much. In times of increased demand there is great anxiety and much trouble in instructing even the generally intelligent girls who are desirous to get this kind of employment.

A sudden change of fashion throws the machines out of work, and with them the workers, and when a demand again occurs, fresh hands have to be instructed. Happily, there is less change in furniture fabrics than in dresses, and thus the best hands are retained ready for an emergency and the instruction of others; but the operative classes are now keenly alive to the disagreeable character of fluctuating employments, alike to employer and employed; and thus the difficulty is increased even to such a house as that of the proprietors of these machines, whose reputation as employers of factory hands has always stood so high.

In concluding this attempt to explain the mechanical principle and economic application of one of the most interesting agents which, in the progress of modern invention, has been brought to bear upon textile decoration, it is only right to state that the imperfections of the exposition are inherent in the subject, and nothing but a very earnest desire to comply with the wishes of the managing officers of the Society of Arts, that a popular explanation of the construction and peculiarities of the embroidering machine should be given to the members, would have induced me to undertake the task, under the many disadvantages which must necessarily arise out of the fact that my connexion with these machines, in a practical form, ceased ten years ago, and I doubt if I have seen them more than three times in the interval.

(To be Continued.)

The Explosion on the Great Eastern.

The cause of the explosion on the *Great Eastern* is thus explained in the Portland correspondence of the *London Times*, Sept. 11 :—

"In order fully to understand, as far as it is yet known, the cause of the accident, it will be necessary to say a few words on the peculiar construction of the two forward funnels for the paddle boilers. In the first plans for the vessel it was determined, in order to economize the heat given off by the funnels, and to keep the saloons through which they passed cool, to fit them all with what is termed a 'feed pipe casing,' rising from the boilers to about eight feet above the upper deck. This feed pipe casing is simply a double or outer funnel for the length we have stated, the inner one, as usual, carrying off the smoke and flame, and the space between it and the outer casing being filled with water. The water is pumped in at the top of the casing while cold, and gradually passing down into the space round the furnaces, becomes greatly heated, when it is discharged into the boilers by means of an ordinary stop-cock. A plan by which so much coolness is supposed to be gained in the berths and saloons, and so much fuel

saved by the ample supply of hot water to the boilers, promises such obvious advantages that for the last ten years attempts of every kind have been made to carry out the principle successfully on board most of the sea-going steamers. In no one instance has the plan ever yet succeeded. In but too many cases the funnels have done what the funnel of the *Great Eastern* did on such a colossal scale last Friday evening. When such an accident has not occurred, the pressure of the column of water upon the base of the funnel near the furnaces has been so great as to cause them, when strained in bad weather or worn by long use, to leak into the fires and extinguish them more or less rapidly. Any one the least conversant with boiler mechanism will see, too, at a glance, that the safety of the whole affair depends upon the stop-cock which lets off the water into the boilers being watched with unremitting vigilance. The neglect of this for half an hour would allow steam to generate in the casing, which would then, in plain terms, become a gigantic boiler, without a valve or any means of letting off its steam, save by blowing up. This was the apparatus which, as I have explained, in order to economize heat and cool the saloons, it was proposed to introduce on board the *Great Eastern* in the three funnels to the screw engine, and the two forward funnels for the paddles. Messrs. Bolton and Watt were entrusted with the construction of the screw engines and boilers, and they at once firmly refused to have any such casing round their funnels, or attached to their engines in any way whatever. I am not aware of the precise reason on which they grounded their refusal, though doubtless they rested mainly on the obvious fact, that the plan had been tried over and over again and always failed, with more or less of inconvenience or disaster. The plan, however, was adopted for the two paddle funnels, though at about that time the Collins' line of steamers, which had tried the plan for nearly three years, discarded it as often dangerous and always worthless. The casings of the two forward funnels of the *Great Eastern* held each about seven or eight tons of water, and the forward one, at least, it is now evident, might have exploded at any moment during the voyage, when the grand saloon was filled with the visitors on board to listen to the admirable music of the ship's band."

The explosion is thus described by the same correspondent:

"The visitors who were passengers on board numbered about 100, and, as may readily be believed, included among them some of the most distinguished navigators, engineers, and scientific men in Europe. All, as usual, were assembled at dinner at about 5½ o'clock on Friday, when before the dessert came on, two gentlemen left the Chairman's table to look at the coast near Hastings. Mr. Campbell, the Marquis of Stafford, Earl of Mount Charles, Lord Alfred Paget, and a few others followed, without waiting for dessert. The departure of these gentlemen from the saloon, as it happened, broke up the dinner party, and instead of retiring to the grand saloon, as usual, nearly all the visitors came on deck, and went right forward in the bows. About 30 remained at table—a few were on the bridge with Mr. Campbell, and thus, by a most merciful interposition, it happened, for the first time

during the voyage, that there was no one sitting in the grand saloon, and no one on the little raised deck round the foremost funnel. One or two gentlemen were congratulating Mr. Campbell on the almost marvellous success of the ship, when in the space of a second there was a terrific explosion. The forward part of the deck appeared to spring like a mine, blowing the funnel up into the air. There was a confused heavy roar, amid which came the awful crash of timber and iron mingled together with frightful uproar, and then all was hidden in a rush of steam. Blinded and almost stunned by the overwhelming concussion, those on the bridge stood motionless in the white vapor till they were reminded of the necessity of seeking shelter by the shower of wreck—glass, gilt work, saloon ornaments, and pieces of wood, which began to fall like rain in all directions. The prolonged clatter of these as they fell prevented any one aft the bridge from moving, and though all knew that a fearful accident had occurred none were aware of its extent, or what was likely next to happen. After a short interval, during which the white steam still obscured all aft the funnel, Captain Comstock, who was on the bridge, tried to see what had occurred, but he could only ascertain, by peering over the edge of the paddle-box, that the vessel's sides were uninjured, and the engines still going. Gradually then, as the steam cleared off, the foremost funnel could be seen lying like a log across the deck, which was covered with bits of glass, gilding, fragments of curtains and silk hangings, window frames, scraps of wood blown into splinters, and a mass of fragments, which had evidently come from the cabin fittings of the lower deck, beneath the grand saloon. In the middle was a great heap of rubbish where the funnel had stood, from which the condensed steam was rushing up in a white, and therefore not hot, vapor, but enough to hide completely all that had happened below. In another minute all the passengers came rushing toward the spot. The 20 or 30 who had remained at table in the saloon next that which blew up came on deck also, and it will give your readers some idea of the gigantic strength of the vessel when I tell them that these latter until they actually saw the smash, were almost unaware of the terrific explosion which had occurred beside them. It was only the dull, heavy roar, followed by the rattling of fragments as they rained down on and through the sky-lights, which warned them that something dreadful had occurred. Still none knew what had really happened or what injury the vessel had sustained. Capt. Harrison, who was aft at the moment, rushed forward, and, seizing a rope, lowered himself down through the steam into the wreck of the grand saloon, and, calling to six men to follow him, began a search among the ruins for those who might have been below. The only one in the apartment was his own little daughter, who had just arrived at the after part at the moment of the explosion, and who, completely sheltered by the wrought iron bulkhead, had escaped, by a miracle, totally unhurt. Capt. Harrison merely gave the order to pass her up through the sky-lights, and continued his search. This was no easy matter. The wreck and rubbish piled in all directions in the ladies' small saloon, forward of the funnel, made it difficult to move about.

The steam hid almost every object; the place was broken, the floor in parts upheaved and riven, so as to show a still more frightful smash in the saloons and cabins below. Through these apertures the bright glare beneath the lower deck of all showed that the furnace doors had either been blown open or blown away, and the funnel being gone, the draft was down the remains of the chimney, forcing out the flames and ashes in a fierce and dangerous stream. This, as the embers touched water, sent up a close, suffocating air—half steam, half gas—in which it was difficult to see, and almost impossible to breathe.

In the meantime, most on board, including the visitors, took steps to restore order and confidence. As I have already said, there were fortunately no holiday tourists there, or the matter would have been much worse. Some of the ablest engineers and machinists were on deck, who could pretty well guess what had happened, and what worse might follow. A funnel, filled similarly to that which had blown up, was evidently getting intensely hot, and of those present none knew to what extent its "jacket," or outer casing, had been damaged, or how soon it might explode. Mr. Scott Russell, followed by one or two engineers, at once went below to the furnaces of these boilers, and ordered the steam to be blown off, the speed of the engines to be reduced, and every precaution taken to guard against mishap. Mr. Campbell remained calm and collected on deck, getting the crew forward and preventing any unnecessary alarm. Some of the men instantly went below to search for those employed in the stoke-holes, whom it was now evident must be fearfully injured, if indeed alive. Mr. Trotman, with one or two others, went below to the lower deck cabins, where one at least was known to be covered by the wreck, while Capt. Harrison came on deck and ordered the ship's course to be altered toward the land till it could be ascertained that there was no immediate danger from fire or injury to the frame of the vessel below. The former risk appeared to be the most imminent, as the flames were still rushing fiercely from the furnace doors. The hose was therefore ordered to be laid on, and instant preparations made for extinguishing the fires.

The hose was got at once into play, and a stream of water was poured down into the stoke-hole beneath the lower deck, so as in a few minutes to quench the fire in the furnaces, and put at rest all fear of danger from that source. Within twenty minutes after the blow-up the real cause and nature of the mishap was known, and the total safety of all the engines and after boilers was definitely ascertained. Fearful as was the explosion, it was seen that, owing to the immense strength of the ship, its violence had been entirely confined to the compartment in which it had occurred, and it was determined to resume the original course and steer for Portland. All danger from fire or another explosion being now at an end, those who chose were enabled to go down and examine for themselves the scene of the disaster. The litter on the deck showed that in the compartment in which it had taken place, and where it was confined by the wrought iron bulkheads, it had been wide and general. The fore part of Mr.

Crace's beautiful saloon was a pile of glittering rubbish, a mere confused mass of boards, carpet shreds, hangings, mirrors, gilt frames, and splinters of ornaments; the rich gilt castings were broken and thrown down, the brass work ripped, the handsome cast iron columns round the funnel overturned and strewed about. In the more forward part, a state sitting-room for ladies, every single thing was destroyed, and the wooden flooring broken and wrenched up. What the consequence would have been if it had taken place an hour later, when the visitors would be sitting in the saloon, is almost fearful to think upon. But the damage in this part seemed a mere bagatelle when compared with the ravages among the lower deck cabins beneath. It was difficult to go down there, for the whole place was filled with fragments of boards, chairs, beds, cabin fittings, broken steam pipes and syphon-tubes, torn-out rivets, and masses of the inner and outer funnels rent to pieces like calico, and lying about like heaps of crumpled cardboard. Everything was in literal fragments. The course of the explosion could then be seen at once. The water, or rather steam, in the casing had crushed in the inner casing, blowing up the funnel above deck, while both funnels below it were torn to pieces, and hurled about, sometimes in single rivets or scraps no longer than one's hand, sometimes in crumpled up lumps weighing several hundred weight. Beneath this deck, toward the stoke-hole, where the remnants of the funnel left a yawning hole like an extinct volcano, the force of the explosion was still more manifest. Not only was the iron compartment nearest to the boiler partly rent and pushed back, but one of the main deck beams, an enormously massive wrought iron girder about two feet deep, and strengthened with angle irons, was wrenched back and nearly bent in halves. In some parts the explosion seems to have acted with the capricious violence of lightning. Thus, in the grand saloon the two largest mirrors on each side of it, running fore and aft, were quite unbroken, though the silvering was boiled off the backs of both by the heat of the steam. By the side of these glasses cast iron columns were bent and broken, and mirrors at four times the distance from the seat of the disaster were almost pulverized, and their framings even destroyed. The beautiful oak stair-cases descending to the saloons were blown up like card-work; yet not a book on the library shelves, close to the funnel, was stirred. At the bottom of the stoke-hole I found one of the gilt framings, which were placed round the windows of the saloon; it was perfectly uninjured. For your readers to understand this singularity they must suppose one house—say number eight—to have had an explosion in its cellar, and among the ruin is found uninjured, a drawing-room picture belonging to the next door neighbor at number nine. The boiler, so far as can be judged from a superficial examination, stands firm; a close scrutiny, however, will be necessary to enable the engineers to determine whether any part of it, more especially its tubes, are injured. It seems almost too much to hope that when such a severe concussion was experienced, it can have escaped entirely without injury. Near and upon the boiler lie scraps

and morsels of the funnels, which show where the first tearing away commenced before the inner casing was blown up to the deck.

The Coroner's inquest on the bodies of the five unfortunate stokers —John Boyd, Michael Mahon, Michael McRoy, Robert Adams, and Richard Edwards—was held at the Town Hall at Weymouth, before Mr. Henry Lock, the Coroner for Dorset.

The first witness examined was James Briscoe, the junior engineer of the paddle engine department, who said that it was his duty to attend to the direction of the engineers in charge of the paddle engines on duty, and to render assistance under their direction. He was told not to meddle with or make himself responsible for any of the cocks or valves. The donkey-engine which pumped into the boiler was out of order, and did not perform its duty satisfactorily. The donkey-engine on the port side of the ship in the forward stoke-hole had broken down. One minute before the explosion, Mr. M'Lennan, the Chief Engineer of the ship, came down to witness, and looked to the saturation of the water in the boilers, and said, on leaving, that everything seemed right; knew that the bursting of the water-heater round the forward funnel caused the explosion. At the time of the explosion, the boilers were not being fed from the casing, which was evident from the low temperature of the water going into the boiler. They had ceased to feed the boilers from the water casing, he believed, to get a greater amount of water into the boiler. If the water casing had been regularly kept supplied with water, and a continual flow in and out, the accident would not have happened. There were two stand-pipes to the water casing, which, if open, would have prevented it.

Mr. Brenton, one of Mr. Brunel's principal engineers, was called to give evidence to the probable cause of the accident. Witness was accompanied in his examination by Mr. M'Connel (the Engineer of the North-Western Railway), Mr. Scott Russell, Mr. Smith (the inventor of the screw-propeller), Mr. W. Smith (a civil engineer), and Mr. Bates, who represented the firm of Bolton & Watt. Witness and those with him came to a conclusion as to the cause of the accident. The double funnel casing was not always applied to other steam boilers. The fact of the wood-work around the funnel being blown away led witness to see the cause of the accident without the drawings or explanations.— They ascertained that the funnel was double for 40 feet of its length, the inside one being 6 feet in diameter, and the outside one 7 feet, leaving a space of 6 inches between the two all round. The water was contained between the two; the explosion took place about half way down, near the lower deck. The inner casing was collapsed, and the outer one burst out. The object of the casing was to prevent the water being led direct to the boilers. There was an apparatus provided to prevent any excessive pressure accumulating in the water-jacket. This apparatus consisted of a "stand-pipe," which was carried to near the level of the top of the funnel, and communicated with the water-jacket, constituting a safety-valve. Being open at top, as soon as the pressure increases it runs out of the "stand-pipe." The height of the column of water regulated the pressure in the jackets. From inquiry, they

learned that the feed-water for the boiler was sent direct to the boiler, without passing through the funnel, as the donkey-engines did not work satisfactorily; one of them being disabled, the other had to do the work of two. That accounted for the fact of the communication between the boilers and the casing being shut off. An explosion ought not to have occurred if the "stand-pipe" was in operation. Their attention was called to the state of the stand-pipe, and they found at the bottom of it a plug capable of being turned. It was shut off, leaving no vent for the steam generated in the case. If the "stand-pipe" had been in operation, or if the feed was continued through the jacket, the explosion would not have occurred. The steam must have gone on generating till the cylinder burst. No one seemed to know how, when, or by whom the cock was shut. Two or three days before the ship sailed, the "stand-pipe" not being high enough, a piece was added to it, so that up to that time the cock must have been open. It was supposed to have been closed by some workman for some purpose, and not to have been again opened. If the cock had been taken off, the accident could never have happened. The cock was put on to test the cases by hydraulic pressure, and had not been removed. The cock could not have been closed by the force of the explosion, or, indeed, witness could not conceive the accident occurring.

The inquest was resumed next day, Mr. John Scott Russell having come from London to be present.

Mr. John Dickson, foreman to Mr. Russell, and under whose superintendence the machinery of the paddle engines was fitted, was also present, and Mr. M'Lennan, the Chief Engineer of the *Great Eastern.*

The Coroner said that, on the opening of the inquest, he at once considered that it was a case which ought to be adjourned, in order that the Jury might have the assistance of some of the surveyors from the Board of Trade. He had accordingly communicated with the Board of Trade, and received a letter in reply the previous day, which stated that it was impossible that Capt. Robertson, the Surveyor-General, could attend the inquiry before Saturday next. He therefore thought that, under those circumstances, it would be most advisable that the Jury should have the benefit of the experience of those officers, and, with their permission, he would adjourn further proceedings till Saturday morning at nine o'clock. He (the Coroner) trusted that both the Company and Mr. Scott Russell would be ready on that occasion with any evidence which could throw the smallest light upon the causes which had led to so disastrous an accident.

Mr. Scott Russell said that it would be proved by witnesses that the cock of the valve was open on Tuesday, and when the vessel left the river on Wednesday.

The inquiry was then adjourned till Saturday morning.

The interest evinced by the public in this part of the country in all relating to the ship seems as great as ever. Nearly 6000 persons paid their half-crowns to go on board, and promenaded the deck all day, defying the squalls of wind and rain with an endurance worthy of a better cause.

The repair of the damages inflicted by the explosion has already commenced, Mr. Scott Russell having contracted to restore the whole for £5000. If it should turn out that either of the forward boilers have been injured, £5000 will scarcely suffice for the entire restoration.—From the fact of there having been no escape of steam from either of the boilers at the time of the explosion, when there was a pressure on each of 22 lbs., it is believed that they have escaped without material injury. The mere joinery of the cabin fittings and the redecoration of the grand saloon can, and doubtless will, soon be completed. With the ironwork, however, it is a different affair. All this must be executed in London from the working drawings of the vessel, and sent down piece-meal by rail to Weymouth, where it can be bolted together on board the ship. Mr. Scott Russell's contract is to finish the whole ship in her former state as she left the river, within three weeks.

New Action of Light.

The Abbè Moigno gives us still a new and curious result of the researches of M. Niepce de St. Victor. If a solution of starch or dextrine be subjected to the action of solar light for a short time, (say for a quarter of an hour, if there be but a very small quantity of matter) it will be found to be completely changed into glucose, (grape sugar) whose presence is easily recognised by the ordinary reactions; and even by its sweet taste. M. Niepce thinks that he has determined that by surrounding the bunches of grapes in the early part of autumn by bags of white paper dipped in tartaric acid, not only their ripening is hastened, but the quantity of sugar which they contain is greatly increased. Tartaric acid is now well-known to have the power of *storing up* the light in the condition of chemical efficacy.

Cosmos, 1st July, 1859, p. 12.

Approximate Quadrature of the Circle.

We take from the *Cosmos* the following pretty geometrical construction for an approximate quadrature of the circle:—

Describe the given circle, and let A B be a diameter. From A set off the quadrant A C, and from C set off in the same direction an arc A C $= 60°$. Bisect the chord A C in E; and from A draw A E, and prolong it until it meets the circumference in F. Then will A F be the side of a square whose area is approximately equal to that of the circle.

The difference of the areas is about $\frac{1}{3747}$.

The Use of Soluble Glass for Preventing Combustion of Wood.

The English government have caused experiments to be made on wood prepared in the following way: first, it was painted over with two or three coats of a feeble solution of the glass (1 vol. of the

siropy solution to 3 of water). The wood absorbs this freely. When these coats were nearly dry, a coating of ordinary whitewash was given, and, when this again was nearly dry, it was fixed by a stronger solution of the soluble glass (2 vols. of sirop to 3 of water). A second application of this will not be necessary, unless the whitewash has been too thick.

The experiments showed that wood thus prepared is almost incombustible, and that it does not scale or split off when the wood becomes hot; rain has no action on it; a long exposure to a powerful jet of water partially washed it off. One pound of soluble glass was sufficient for a surface of a square yard.

For the Journal of the Franklin Institute.

Particulars of the Steamer De Soto.

Hull built by Lawrence & Foulkes. Machinery by Morgan Iron Works, New York. Intended service, New Orleans and New York.

Hull.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck,		252 feet.
Breadth of beam at midship section,		38 " 8 inches.
Floor timber, at throat—molded, 16 ins.—sided, 14 ins.		
Frames—apart at centres, 28 inches—strapped with diagonal and double laid iron straps, $4 \times \frac{3}{8}$ inches.		
Depth of hold,		19 " 2 "
" to spar deck,		26 " 8 "
Draft of water at load line,		15 "
Area of immersed midship section at this draft,	530 sq. ft.	
Tonnage, custom-house,	1600.	
Masts and rig—Brig.		

Engine.—Vertical beam.

Diameter of cylinder,		65 inches.
Length of stroke,		11 feet.
Maximum pressure of steam in pounds,	20.	
Cut-off—half stroke.		
Maximum revolutions per minute,	18.	

Boilers.—Two—Single return flued.

Length of boilers,		27 feet.
Breadth "		12 "
Height " exclusive of steam chimney,		10 "
Number of furnaces,	(3 in each.) 6.	
Breadth "		38 & 44 "
Length of grate bars,		7 " 6 "
Number of flues,	36.	
Internal diameter of flues,	8, 10, 11, 12, 13, and 16 in.	
Length of flues,		19 ft. 6 in. and 13 " 3 "
Diameter of smoke pipe,		6 " 6 "
Height "		32 "
Description of coal,	Anthracite.	

Paddle Wheels.—

Diameter,		30 "
Length of blades,		9 "
Depth "		18 "
Number "	26.	

C. H. H.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 15, 1859.

William B. Atkinson, President P. T., in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter from the Mercantile Library Association, of the City of New York, was read.

Donations to the Library were received from the Institute of Actuaries, London; the Commissioners of Patents, Washington, D. C.; the Mercantile Library Association, City of New York; Profs. J. C. Cresson and J. F. Frazer, and Messrs. Jones, White, & McCurdy, and H. P. M. Birkinbine, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of August, was read.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Exhibitions reported that, at their stated meeting held August 9th, they awarded a first class premium to Appleton, Tracy & Co., of Philadelphia, for their American Watches, and to John F. Mascher of Philadelphia, for his Railway Timing Clock, on the reports of the Committee on Science and the Arts.

Candidates for membership in the Institute (6) were proposed, and the candidates (5) proposed at the last meeting were duly elected.

A number of photographic views of the extension of the Philadelphia Water Works, were then presented by H. P. M. Birkinbine, Esq.

Mr. P. Shreiner presented his patent stove, which he illustrated by a model and drawing, and explained as follows:—It does away the objection usually made to iron cylinders, by forming *air-tubes* out of a portion of the cylinder, and causing a strong current of air to pass along the cylinder to the drums placed in the interior of the furnace. This is perfectly gas tight at the top, and by an increased rush of cold air through the tubes, prevents the cylinder and drums from becoming red hot, thus securing a more healthful heat. By retaining in a cylinder or chamber above the fire-pot, and taking it rapidly out of the retainer, by the introduction of cold air by means of an extra cylinder which surrounds the retainer, the heat is prevented from escaping through the smoke-pipe, but is distributed through the apartments of the building. The smoke and gas are consumed by being compressed or forced back in contact with the fire. The gas being consumed, one source of destruction to the chimney is removed—the formation of sulphuric acid by admixture with the oxygen of the air.

He also showed how his invention radiated the heat in direct lines from all parts of its surface, and, by being encased, produced a double air heater. An ordinary heater with but capacity sufficient to heat

one room, by his improvement, can be increased in heating power so as to produce sufficient to heat an additional room of equal dimensions above. He claims a great saving of fuel, and freedom from dust in the room in which it is placed.

It is equally advantageous for cooking purposes, but want of time has prevented the inventor from furnishing models elucidating all its advantages.

One has been ordered, and is now being prepared, for the State Normal School at Millersville, Lancaster County.

Mr. Raif exhibited a small model of a machine to print the names of subscribers on newspapers, &c. It is a series of type boxes on an endless band; and, by depressing a lever, the letters are inked, and the paper brought up, printed and pushed off, ready for the next.

Mr. I. N. Coffin exhibited a Batchelder's Lamp for burning coal oils without a chimney, for which he obtained a patent Dec. 28, 1858. He stated that this lamp is designed for burning all kinds of coal oils without employing the common glass chimney, and thus avoiding the expense of their breaking and the inconvenience of the lamp getting out of order from that cause, and also to obtain the greatest amount of illumination from the combustion of a given amount of oil. The invention consists in the use of tapers or wick tubes, placed below and on both sides of a flat wick tube or main illuminating burner, in combination with a suitable cap, thus supplying sufficient oxygen completely to burn the oil without a chimney, and also without raising the cap so as to obscure a large portion of the flame. The lower part of the cap is screwed upon the lamp in the usual manner. Above this is a reticulated ring for the purpose of admitting air under the wick cap, which is slotted at the top to fit a flat wick. This ring is removable for the purpose of cleaning. By the contraction of the cap near the top, the air is concentrated upon the flame. Into the lower part of the cap are inserted the usual wick tube, and likewise two very small and short wick tubes. By this arrangement, the lamp when trimmed and lighted, has a stronger draft on account of the tapers in the short tubes; consequently the outer cap may be lowered upon the main wick tube, so that the illuminating flame is almost entirely above the cap. In other lamps where the draft is to be produced by the wick cap alone, it is necessary to elevate this cap so as to give a considerable volume of heated air in the upper part of the cap, in order to create sufficient draft; but this elevation of the cap obscures more of the flame and lessens the illuminating power of the lamp. On the contrary, by the use of the small draft lights, the top of the cap may be adjusted about half an inch lower upon the illuminating burner without causing the lamp to smoke; consequently it is practicable to secure a greater illuminating power from a given amount of oil, and to dispense altogether with glass chimneys, which are liable to break, difficult to keep clean, and otherwise objectionable. For further information, letters, or orders for the lamp, or for County or State rights of the patent, may be addressed to Isaac N. Coffin, care of Dr. William B. Atkinson, No. 215 Spruce Street, Philadelphia.

Abstract of Meteorological Observations for July, 1859; *made in Philadelphia, Somerset, Dauphin, and Centre Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.*

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

1859. July.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Relative humidity. 2 P. M.	Force of vapor. 2 P. M.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.	Direc.
1	29·915	·120	79·7	27	6·3	44	·461		(var.)
2	29·736	·179	81·5	28½	10·8	60	·890		S W.
3	29·690	·102	72·7	20½	11·2	80	·821	0·529	W.
4	30·032	·342	63·2	17⅓	9·5	44	·322		N W.
5	30·197	·164	68·5	20	5·3	32	·268		N N E.
6	30·109	·088	71·3	25	2·8	33	·327		N E.
☾ 7	30·013	·096	71·8	23	2·8	49	·504		N E.
8	29·982	·031	74·0	10	2·2	45	·495		S S W
9	29·978	·032	80·2	23	6·2	47	·588		(var.)
10	30·043	·065	76·0	23	4·5	39	·503		S S E.
11	29·991	·052	79·5	23	3·5	44	·574		S W.
12	29·864	·127	85·2	25	5 7	47	·747		S W.
13	29·811	·006	80·5	25	5·3	50	·818	1·148	(var.)
○14	29·890	·079	82·7	20½	3·8	55	·773		(var.)
15	29·914	·051	75·8	15	6·8	45	·472		S E.
16	29·732	·182	75 7	15	0·8	71	·772	0·355	N.
17	29.721	·031	80·5	22	4·8	58	·733		N.
18	29·743	·022	84·5	20	5·7	46	·671	0·220	(var.)
19	29·642	·101	77·7	12	6·8	78	·800	0·035	N N E.
20	29·600	·082	80·8	22	4·8	42	·608		N W.
21	29·787	·188	75·5	17	5·3	47	·464		S W.
☽22	29·640	·148	74·3	14	1 8	66	676	0·695	S W.
23	29 700	·118	74·7	16	3·7	36	·344		N W.
24	29·826	·126	72·7	23	3·3	43	·443		S W.
25	29 803	·023	72·8	14	3·5	75	·659	0·002	(var.)
26	29 738	·004	70·5	15	3·7	67	·730	0·940	S S W.
27	29 720	·047	72·2	20	4·3	47	·438		N W.
28	29·781	·060	74·0	20	1·8	43	·429		W N W
●29	29·923	·142	76·2	23½	2·2	38	·428		W S W.
30	29·969	·046	76·7	21	9·5	43	·482		S W.
31	29 910	·071	71·7	16	5·0	61	·563		S W.
Means	29·852	·099	76·0	20	4·7	51	·574	3·915	N 84° W

SOMERSET, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.

HARRISBURG, Dauphin Co. 40° 16′, N. 76° 15′, W. JOHN HEISELY, M D., Obs.

FLEMING, Centre Co. 40° 55′ N. 77° 53′ W. Ht. 780 ft. S. BRUGGER, Obs.

July.	Somerset Bar. Mean.	Somerset Ther. Mean.	Somerset Relative humidity. 2 P. M.	Somerset Force of vapor. 2 P. M.	Somerset Rain.	Somerset Prevail'g winds	Harrisburg Bar. Mean.	Harrisburg Ther. Mean	Harrisburg Rain.	Harrisburg Prevail'g winds.	Fleming Ther. Mean.	Fleming Rain.	Fleming Prevailing winds.
	Inch.	°	Per ct.	Inch.	Inch.	Direc.	Inch.	°	Inch.	Direc.	°	Inch.	Direc.
1	27·704	69·3	56	·635		S W.	29·790	76·3		S W.	69·0		N W.
2	27·613	74·3	55	·704	0·643	(var.)	29·627	85·3	0·208	S.	79 7	0·355	S W.
3	27·625	65·7	68	·614	0·266	W.	29·623	75·3	0·424	W.	71·0	0·232	(var.)
4	27·876	55·7	55	·362		N E.				N W.	58·7		(var.)
5	27·965	58 3	52	366		N E.	30.116	68·9		N.	60 7		(var.)
6	27·940	53·3	79	·387	0·985	?	30·013	72·7		W.	61·3		N W.
7	27·842	63·3	53	·455		E.	29·938	75 0		S E.	64·3		(var.)
8	27·812	68·3	62	·611		S E.	29·906	78·3		S E.	72·7		S W.
9	27·813	71·7	56	·609		E.	29·884	82·7		S.	75·7		(var.)
10	27 867	74·9	56	·635		E S E.	29·952	82·0		S.	75·3		S E.
11	27·846	75·0	58	·747		W.	29·907	82·0		S.	78·0		W.
12	27·797	77·0	53	727		N N W.	29·807	87·0		S.	80·0		W.
13	27·760	80·0	54	·813		N W.	29·723	90·3		W.	85·0		N W.
14	27·745	82·3	56	·950		(var.)	29·781	87·3		S.	84·0		(var.)
15	27·687	72·3	81	·704	0·268	S E.	29·800	76 7	} 2·070	S E.	75 3	0·792	S W.
16	27·618	75·0	62	·683		N W.	29·639	80·7		W.	76·3		N W.
17	27·642	76·7	57	·771	9·940	W.	29·636	84·9		W.	79·0	0·042	W.
18	27·644	77·0	52	·743		W.	29 647	86·3	0·646	W.	82·0	0·050	S W.
19	27·527	74·7	71	·772	0·396	(var.)	29·520	83·0		S.	77 3		N W.
20	27·533	73 0	64	·745		W N W	29·509	85·0		(var.)	75·7		W.
21	27·628	68·7	58	·598		(var.)	29·695	77·0		N.	68·7		(var.)
22	27·497	69·0	53	·529	0·936	W.	29 489	80·7		(var.)	73·3	0·130	(var.)
23	27 593	64·0	67	·545		(var.)	29·604	76·3		N W.	65·0		N W.
24	27·654	64·3	53	·491		S.	29·736	74·0		S.	64·3		N W.
25	27·621	70·0	51	·540		N W.	29·671	79 3		S W.	75·7		(var.)
26	27·618	70·0	55	·498		W N W	29·562	80·3		N W.	70 3		N W.
27	27·641	61·7	56	·397		N W.	29·636	75·0		N W.	67·3		N W.
28	27·672	59·3	52	·384		N W.				W.	66·7		N W.
29	27·734	63·0	56	·504		N W.	29·832	75·7		S.	68 0		(var.)
30	27·760	67·0	47	·395		(var.)	29·875	77·7		S.	68·9		(var.)
31	27·670	71·7	51	·522	0·027	S.	29·791	75·7		S.	74 0		S E.
Means	27·708	69·3	58	·595	1·761		29·745	79·6	3·348		72·3	1·691	

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1859.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Description of a Magnetic Apparatus for adding Adhesive Force to the Driving Wheels of Locomotives. By EDWARD W. SERRELL, Civil Engineer.

Almost all locomotives that have been built heretofore, have an excess of steam power over their adhesion, and where this is not the case, the great weight that necessarily ensues, in some cases amounting to several tons beyond what is required for the proper strength of the parts, is not only an unnecessary load to carry every mile that the engine travels, but is so much dead weight producing impact by which the track and bridges, and in fact the whole superstructure is sooner or later destroyed.

The difficulties railway companies experience are manifold from the use of heavy engines. Not only the track is destroyed, and the bridges impaired, but the machinery itself more readily wears out its own parts by their great weight, and much more lubricating material is required; but railway managers find themselves forced between the two horns of a dilemma; for if they use light engines, there is not adhesion sufficient to draw the heavy loads necessary to a profitable business; while if heavy machinery is employed, it works its own destruction and that of the track on which it moves.

The destruction of superstructure due to locomotives of great weights has been carefully computed by the learned commissioners appointed

by the States of New York and Massachusetts, and by several other eminent engineers, among whom may be mentioned my friend William Raymond Lee, who has accomplished much to put this important question in its true light, as has also Mr. McAlpine and Charles B. Stuart, and others, and it has been found that the depreciation from this cause amounts to upwards of $26,000,000 per annum in the United States alone.

Appreciating these difficulties, I went to work to see what could be done to remedy them, believing that science and experience combined could surely correct such grave errors, as there must be in a system that resulted so destructively to its own best interests, and to this end I drew upon the intelligence of all my good friends in this country, Canada, England, France, and Germany.

The replies, without exception, were, "You must increase the adhesion of the driving wheels without adding weight to the engine." This was known to be necessary; but how to do it was the difficulty; and although some encouraged the hope, and others suggested the belief that it could be accomplished by various mechanical contrivances; nothing was proposed, however, that had not before been tried, and I was about to give up the investigation of the matter, and consider the case as one of those inevitable troubles that surround every thing in some form, when reading the researches of my friend, the eminent philosopher, Dr. Henry, I was led to suppose that magnetism in some way might come to the rescue.

I was aware that attempts had been made in England to render the driving wheels permanently magnetic, and that the engineers of the *Chemins De Fer Du Nord*, in France, had tried various forms of electro-magnetic helices, but all these attempts had proved failures. I therefore set about making inquiries in this direction, from those best informed in that branch of physical science to which this subject belongs. I met, however, with little to hope from, perhaps, because of the preconceived idea, in one sense true, that a ring could not be magnetized; but struggling on, as one trying to find his way in an unknown place in the dark, and success has at last crowned the effort.

The apparatus consists of a helical coil of copper wire or some other proper electrode placed transversely to the wheel and around the lower segment, in such manner that the wheel may revolve freely within it without at any point coming in contact with it. The helix is sustained in any convenient way to the frame of the engine, and consists in the experiments tried of about 300 turns of No. 8 copper wire, insulated with cotton and marine glue.

One peculiar feature of the helix is, that it is a segment struck from a radius of the diameter of the wheel, which was found to be necessary in order that the greatest magnetic effect might coincide with the point of contact between the wheel and rail.

My first battery consisted of sixteen Groves cells, so modified that they would not stop by the motion of the engine; each cell had about 300 inches of zinc surface, and corresponding opposites of platinum and carbon, and the cells were connected in sets of eight for quantity

—zinc to zinc, &c. My present batteries are a modification of SMEES and CHESTER'S, which are found to be much more convenient.

By this arrangement, with the ordinary thickness of tire, the wheel is so magnetized as to enable the engine to exert its whole steam capacity. With two out of four drivers magnetized, of the engine "*Anthracite*," of the Fitchburg company, it was found that there was an increased adhesion of the wheels, and consequently of the traction of the engine, of over 75 per cent. The steam capacity of the engine being nearly double its adhesion without magnetism, enabled me to use the whole of the magnetic effect.

I am indebted to Mr. O. D. Vormus, of Boston, for very important aid in the experimentations, the troubles and difficulties attending which I shall not weary you with.

The engine "*Lebanon*" of the Central Railway of New Jersey, has two helices of 288 turns of No. 8 copper wire, on the front pair of the four driving wheels, which are four and a half feet in diameter, and the battery is made in four cells, each having twenty square feet of zinc surface, and eighteen feet of silvered lead coated with platinum, sulphuric acid, ($HO.\ SO_3$,) 1, water 12 is used to excite action, and the battery is connected for intensity. I am now preparing a magneto-electric machine to produce the electric current, hoping to dispense with the use of the battery altogether, and if successful, the entire arrangement will be mechanical and independent of chemical apparatus. Some of the engines of the Central Road of New Jersey, and the Erie Railroad of New York, have from three to five tons dead weight of cast iron, that can be taken off, and has been put on to give adhesion, and is otherwise useless.

This arrangement not only saves the great additional useless weight carried, and which is so detrimental to the superstructure, but enables the engine to ascend high grades. With a model, an ascent of a plane of 300 feet to the mile is readily made when the wheels are magnetized. The same model will not go up a grade of eighty feet to the mile without magnetism, because the wheels slip. The model is merely illustrative, and is capable of carrying about two hundred pounds.

The following is the test applied to the *Anthracite:*

Engine chained up.

Slipped wheels on clean track in good condition; circumstances every way favorable to traction, without magnetism, 50 lbs. steam to the inch.

All the conditions alike and two wheels magnetized, slipped with 88 lbs. of steam per square inch; slippery track, 19 lbs. less steam to the inch, without magnetism; same conditions, with magnetism, required 35 lbs. steam to the inch.

The engine weighed 22 tons net, and the additional traction produced by the magnetism was equal to 17 tons of dead weight, but did not weigh any thing.

The "*Lebanon*" drew a coal train on a slippery rail equal to that which was being moved by another engine that weighed about fifteen tons more, and both starting together, the *Lebanon* kept out of the

way of the other for some forty miles or more, when a leak occurring in the fire-box, sufficient steam could not be made to turn the wheels, and eight of the cars had to be taken off. The train had, however, previously passed the heaviest summits of the road.

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*Submarine Electro-telegraphic Experiments.**

We were invited last week to witness some interesting Experiments on the Patent Caoutchouc Telegraphic Insulator, at Messrs. Silver & Co.'s Establishment at North Woolwich. Mr. West, inventor of the India rubber covered wire, conducted the experiments, and gave an account of his researches in connexion with the process. As long ago as 1838 he commenced using india rubber for insulating wires. In 1845 he entered into an arrangement with Sir Joseph Paxton, Mr. Charles Dickens, and other gentlemen, to lay down a submarine cable between France and England, on the caoutchouc insulating principle; but, although the sanction of the English Government was obtained to the undertaking, that of the French Government was withheld for so long a period as to render it impossible to carry it out at that time. But in 1846 a portion of the cable which had been made by Mr. West to lay down across the Channel was, with the consent of the Lords of the Admiralty, submerged in Portsmouth harbor, and a letter was read from Mr. Hay, the chemical referee and lecturer attached to the dock-yard, dated May 25, 1859, in which Mr. Hay states that, notwithstanding that the cable in question has been in constant use, exposed in places to the sun, strained over rough stones, frequently coiled and uncoiled, and treated very roughly, the insulation is now quite perfect, although thirteen years have elapsed since it was laid down. A portion of this cable was exhibited. Mr. West's improvements, for which he has taken out a patent, consist in manipulating and applying the india rubber. In consequence of this substance not becoming plastic at a low temperature, it is impossible to draw it on the wire like maccaroni or gutta percha; it is, therefore, wound spirally round it; but as caoutchouc is not homogeneous, and the want of cohesion in the overlapping would render it liable to the permeation of water, Mr. West was under the necessity of inventing a method of overcoming this defect. The experiments testified that he has perfectly succeeded, and specimens of his cable, which were exhibited, showed that the india rubber is rendered perfectly solid and homogeneous. The quick and easy manner in which it can be repaired in case of abrasion or cutting is another great advantage of his process, while experiments showed that the electric fluid is transmitted without lateral loss, thereby rendering the use of batteries of great power unnecessary. It has been ascertained that india rubber insulates ten times better than caoutchouc, which is too porous to admit of perfect insulation. Care must be taken, however, to use the Para caoutchouc, as that derived from the East Indies is of an inferior quality and becomes "treacley,"

* From the Lond. Athenæum, June, 1859.

and consequently unfit to act as a good insulator. Careful experiments made to test the resistance of the india rubber covered wire to great atmospheric pressure, showed that with a pressure of 1300 atmospheres, equivalent to between two and three times that of the greatest depth of the Atlantic, insulation remained perfect. Mr. West stated that the object of the Messrs. Silver was to invite public attention to their production, with a view to having the most searching investigation into its merits,—not dogmatically putting it forth as a perfect invention, but seeking to elicit by the most open and unreserved exposition of its qualities, the truth with regard to its capabilities. The importance of the subject cannot, indeed, be overestimated —particularly at this period, when the convulsed state of the Continent has, within the last few days, led Government to decide on laying down a submarine telegraph between England and Gibraltar. Successes have been achieved by gutta percha, while on the other hand, great losses have occurred. The successes have only been on short lines, while the reverses have been on long lines, and experience seems to show that after a few years' use caoutchouc deteriorates so sensibly as to be no longer a perfect insulator.

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*A Coincident Period in American Statistics.**

By adding successively a cipher or ciphers, the figures "29,636" will express the present (1st July, 1859) sum of the railroads, post routes, territorial extent and population of the United States. Thus we have approximately:

Miles of railroad, . . .	29,636
Miles of post-route, . . .	296,360
Square miles of territory, . . .	2,963,600
Mouths in population, . .	29,636,000

—facts exhibiting in their representative numbers a progression equivalent to our dollar, dime, cent and mill system of money; and eminently typical of American "go-aheadativeness," which abhors to do anything by *halves*. Such a concurrence of arithmetical idiosyncracies may never again occur, and never will unless our "fillibusters" succeed in enlarging "the area of freedom" in a ratio commensurate with the expansion of our population and the development of our means of internal communication.

* From the Jour. of the American Geographical and Statistical Society, July, 1859.

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*The Hydraulic Lift at the Victoria Docks.** Invented by Mr. Edwin Clark.

On Wednesday, the 27th of July, many who are interested in the progress of science had the pleasure of seeing in successful operation at the Victoria Docks Mr. Edwin Clark's method of ship-lifting, which appears likely to supersede the graving dock for many purposes. Mr. Clark's apparatus consists of a series of thirty-two upright hydraulic

* From the Lond. Mechanics' Magazine, August, 1859.

rams, of ten inches in diameter, placed in a water-way in two lines of sixteen each, far enough apart to admit of a ship of any burden passing between. Each ram is fitted with a cross-head of wrought iron, and the cross-heads are supplied with long straps, to the lower end of which are connected girders extending across from row to row. These girders, when the rams are down, are of course at the bottom of the water. The pontoon, on which the ship is raised, is formed of wrought iron plate, strongly ribbed, the length and depth of which varies according to the size of the ship it is intended to lift. This pontoon is open at the top, and is of sufficient buoyancy, when empty, to support a vessel of very large tonnage. It is fitted with screw valves for admitting the water, so that in a very short time, when placed in position, it can be lowered down upon the cross girders. The rams are fed by a 50 lb. engine, which is fitted with twelve hydraulic pumps, $1\frac{7}{8}$th in. diameter, and 2 ft. stroke, working at 18 strokes per minute, and the pipes from these pumps, before branching off to the rams, communicate with a series of valves arranged in a place built for that purpose close to the lift. By means of eccentrics, which close the valves, any one of the rams can be disconnected at will from the supply, so that should one of the pipes burst, no danger can accrue to the ship, and the lifting process can be completed without delay.

At half-past 1 o'clock on Wednesday, the 27th, the pontoon being placed in position upon the girders, it was first filled and then lowered to the bottom of the water. After this the Jason, a ship of about 1000 tons burden, was warped in, and having been fixed in position by means of ten sliding blocks, which were pulled into contact with the sides and bottom by means of chains brought above the water line, the engine was set to work, and the whole mass rose gradually out of the water at a speed of one foot in three minutes. As the pontoon came above the surface, it relieved itself of the water it contained, and the valves being then closed, the buoyancy of the saucer itself supported the ship in a perfectly steady and satisfactory manner. The whole operation, from the beginning to the end, extended over the space of $1\frac{1}{2}$ hours, and the dead weight lifted, including the pontoon, was altogether above 1600 tons. There are four pontoons constructed, and others in course of construction, which when raised in this manner, and floated, are to be towed with their burden into shallow bricked recesses provided for that purpose, so that the hydraulic power can be continuously applied for raising purposes. During an entertainment which followed the experiment, or rather the operation, Mr. Edwin Clark laid before his audience a clear and concise description of his invention, and the obstacles he had had to contend with in bringing it to its present state of perfection.

The engraving No. 1 shows a cross section of the lift, with a ship in the act of being raised. A A are two of the columns in which the rams are placed; B shows one of the cross girders; C; the end of the pontoon; D D, two of the sliding blocks for steadying the ship; and E E are two double purchase crabs for raising weights, and lifting the rams when required. These can be run about any where upon the top platforms, and are very useful adjuncts.

Engraving No. 2 is a section, in detail, of one of the columns, showing the ram, which is lettered A, the cross-head B, the side rods C C, and the cap-plate D. It will be noticed that the hydraulic cylinder

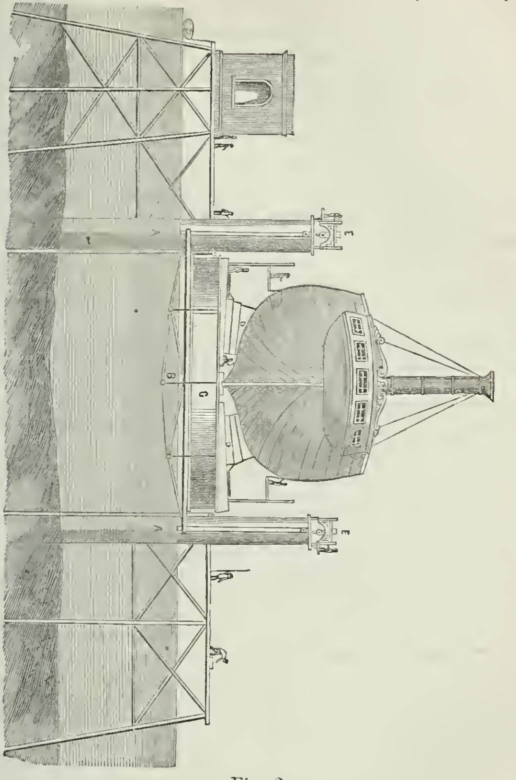
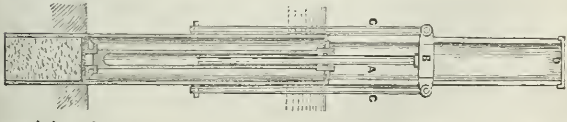


Fig. 1.

Fig. 2.



containing the ram rests upon a block of concrete, which fills up the inside of the column to the required height.

It will be needless for us to say much more upon the subject of Mr. Clark's invention. Its superiority over the old graving dock for many purposes is sufficiently manifest. Instead of a vast outlay upon excavations, masonry, and elaborate machinery in each instance, one hydraulic lift will do the work of any number of graving docks; and the only expense, beyond the first outlay, is providing an adequate number of pontoons for the work, and water space of any kind beyond three feet deep for floating them in.

Steam Engineering in 1859.*

Introductory.—No apology is required for calling attention to the present state of steam engineering, especially when it is a well-known fact that, at no previous period has there been a greater spirit of inquiry respecting the duty that should be realized from the steam engine than at the present time; indeed, it may be said, that among engineers themselves, there is a decided feeling of dissatisfaction on this point.

The following observations are entirely of a general character, preparatory to a consideration of details, and they are intended to refer to what *has been* done, what *is being* done, and what *can* be done; also how far the present state of steam engineering will compare with the days and deeds of Watt, after crediting him with the mechanical improvements of nearly a century.

In 1769, James Watt specified his three great inventions:—separate condenser; encasing the working cylinder with steam or other source of heat, to prevent premature condensation; and employing the expansive action of steam.

The title of this specification was, "A Method for Lessening the Consumption of Fuel in Fire-engines." The inventions were not merely mechanical improvements, but they were the development of the principle on which Watt based all his hopes of economy—namely, that HEAT IS THE SOURCE OF ALL POWER IN STEAM; and his aim was to prevent all needless and premature condensation, and consequent loss of power.

His correspondence also, and the nature of the inventions referred to, prove his belief that heat is the mainspring of the steam engine. The truth and correctness of that belief have been fully manifest in the experience of the period that has elapsed since 1769.

Previous to Watt's inventions, when, in Newcomen's engines, the condenser was the working cylinder itself, the waste heat in this defective system amounted to more than three-fourths of the total steam generated; and when to that waste were added other losses incidental to the generation and working of the steam in a defective machine, the result realized was a mere fraction of the power represented in the combustion of the fuel.

Watt's first invention of the separate condenser lessened the waste condensation to a great extent; his second invention of encasing the

*From the Lond. Artizan, May, 1859.

working cylinder with steam, &c., was only an extended application of the principle of the first; and his third invention of using the expansive action of steam, could only be applied with success in combination with the other two: indeed, they are such a united trio that, in condensing engines, neither can be dispensed with without involving a considerable loss of effect, even when working with steam of only atmospheric pressure.

It is not a doubtful but a well proved fact, that steam cannot be deprived of its temperature, without a proportionate loss of its pressure; it is also a well known fact, when steam of a certain temperature, say 250°, is brought into contact with iron, wood, or air, having a temperature of say 80° only, there is a constant action going on proportionate to the conducting powers of the low temperature material, by which the steam is deprived of a portion of its heat and pressure, and the loss thereby increases rapidly with the difference between the two temperatures.

As a homely illustration on this point, we may refer to the effect of different temperatures in the case of the human body and the atmosphere in which it may exist. In the human body, the average temperature is 90°, and we find that we cannot remain in a surrounding temperature of 32° without losing a considerable portion of our sensible heat.

The amount of the loss, by conduction and radiation, in the steam engine, is dependent on many circumstances. It is enough at present to draw attention to the fact that there is a loss, and that a considerable one.

To the appreciation of the importance of preserving the heat in steam intact, was due, to a great extent, Watt's success as an improver of the steam engine, and, whenever such preservation is neglected, loss and partial failure are inevitable.

It is not assumed that any new ideas or facts are developed in the preceding remarks; they are only intended to direct attention to those true principles of economy in the development of steam power, without which that economy is impossible, and one reason for referring to what may be termed first principles is, that we may have to trace present defects to their neglect.

There must, of necessity, be a difference between the results of theoretical calculation and those of practical experiment, but it is not a necessity that the amount of that difference should average more in 1859 than in the days of Watt, after crediting him with the advantages of mechanical construction we now possess.

It is to be feared that these mechanical advantages are more than counterbalanced by neglect of the true principles of economy in the use of steam, and that we are utilizing a smaller per centage of the total power of steam than Watt himself.

In these introductory remarks we shall not refer to certain sources of loss in the *generation* of steam, or to those arising from the difficulty of utilizing the heat in the condensed or exhausted steam; these will be referred to on a subsequent occasion.

We may fairly compare the duty of the steam engine, as improved by Watt in 1769, with the average duty realized by steam engines now in general use; and we will only notice *exeeptive* cases when they prove that an increased duty is both possible and practicable.

There are three separate classes—the professional, manufacturing, and the purchasing—immediately interested in the construction of a steam engine, each of which has its own particular influence.

The professional engineer is comparatively of a late creation, and his influence is quite subservient to that of the manufacturer or the purchaser; his position and success in life are, to a great extent, dependent upon his opinions being somewhat in advance of the age, and if he unites a fair amount of scientific knowlege with sound practical experience, he will not encourage the perpetuation of unsound and defective engineering; his responsibility and power are at present very limited, and it would be unjust to blame him for departures from true principles, when such have been the result of circumstances over which he had no control.

The manufacturing engineer has to satisfy the claims of what are too often opposite and conflicting interests. On the one hand he is supposed to supply the market with the best description of steam engines, and on the other he has to make money, and avoid what may be called needless expenditure in producing his goods; he is also influenced by the opinions and requirements of his customers.

Now it does not follow that in manufacture the *cheapest* is the *best*; on the contrary, it is too often the other way, for it is well known, to produce an article at a cheap rate, and make the sale of it profitable, repetition must be encouraged, and alteration avoided.

To take an instance: in manufacturing a steam engine a certain outlay is required for patterns, and when it is purchased at the market price for engines of a certain class and size, in a general way, that price is not affected by the cost of the patterns; but it is of every consequence to the manufacturer, as a matter of profit or loss, whether that cost is debited to one engine or to twenty; it follows, therefore, that, in this instance, there is in the process of manufacturing steam engines a great inducement to repetition, in opposition to the more important demand for improvements tending to economy and general efficiency. And we may add, there is little hope of an immediate change in a system that, unfortunately, opposes such a strong barrier to real improvements, for the reason that a manufacturer will not ruin himself to benefit his customer.

We must look to the increasing intelligence among the purchasers and users of steam power for the change required, the influence exercised in the production and quality of steam power by the third or purchasing class being greater than is generally supposed. The man who holds the purse-strings is the man of influence, and the engineering character of the manufacturer has been, and always will be, greatly changed and modified by that of the purchaser.

Such a state of depressed improvement is not to be submitted to without a murmur, nor is it at all evident that great changes for the

better could not be made if the manufacturing engineer was more constantly and pointedly to enlighten the dark understanding of his customers.

The best interests of the employer of steam power are, in truth, identical with the purchase and use of the best and most economical machinery; and we believe the manufacturing engineer will ever prefer to lead the van in efficiency and economy, if he is allowed a fair profit on his manufactures.

And now, having stated *some* of the drawbacks to extensive improvements in the production and use of steam power, we wish to call attention to the actual efficiency of the steam engine of 1859.

We have previously referred to the three inventions specified by Watt in 1769, and we propose to inquire what actual duty *has been realized* in engines, constructed in accordance with the principles of that specification.

The first practical application of steam power was for the purpose of pumping, and in no class of engine have economical principles of construction received such attention as in that used for removing water from deep mines; and it may be observed incidentally, with reference to the expansive action of steam, it was peculiarly adapted to the conditions of pumping, where great variation of power was requisite.

In Cornwall the duty performed by pumping engines has been regularly tabulated for some years, and the amount of that duty has, in several instances, amounted to upwards of 90,000,000 lbs., raised 1 ft. high in an hour, with a consumption of a bushel of coals, or 94 lbs.; and if to the above duty is added the friction of the engine and pumps, an indicated or actual power has been, and can be, obtained by the consumption of *less* than 2 lbs. of Welsh coal per hour.

The average duty of a number of engines working at different rates of expansion in Cornwall may be much less than the above; but whenever due attention is paid to the maintenance of the heat of the steam in the cylinder, and full scope is allowed to expansive working, the above economy can always be realized.

In the case of condensing engines, for driving mills and manufactories, in which steam jackets and expansion have been combined, an indicated or actual horse power has been obtained, without difficulty, with a consumption *not exceeding* 2½ lbs. of coal per hour.

We therefore maintain that, by attending to the principles of Watt's specification, an indicated or actual horse power can always be obtained from a well made steam engine, on land or on sea, by a consumption of good steam coal *not exceeding* 2½ lbs. per hour; and we are aware that this statement is more moderate than well established facts require; indeed, there is every reason to believe we might fairly adopt a much higher standard of economy.

As a concluding remark on this part of the subject, in no instance on record has the best result or highest duty been realized without special arrangements for maintaining intact the temperature of the working steam and extensive expansive action.

Our next inquiry is:—What is the *average* duty realized at the pre-

sent time on land and on sea for the consumption of a given amount of coal? In reply to this, the following may be fairly assumed as undisputed facts:—

1. That, with land condensing engines, the average consumption of good steam coal per hour, to obtain an indicated or actual horse power, is *not less* than 4 lbs.

2. That, with marine engines of the best general construction, made by first class firms, the consumption of good steam coal per hour, necessary to obtain an indicated or actual horse power, is *not less* than 4½ lbs.

3. That, except in a few instances, no provision is made for *maintaining the temperature of steam* in the steam pipes and passages, and during its expansion in the cylinder, either in land or marine engines.

4. That the advantages derived from the expansive action of steam when the temperature of the steam is *not* preserved, are often so slight as to throw discredit on a principle which, when properly applied, is invaluable in economizing fuel.

The conclusions to be drawn from the above are far from satisfactory, and quite justify the tone of these introductory remarks.

The steam engineering of 1859 is in a most defective condition, and the results of such deficiency are incalculable.

In steamships alone we have at least one and a half millions of actual or indicated horse power; and if we only suppose this power to be exerted during one month out of the twelve, we are needlessly throwing away fuel to the amount of 100,000 tons per annum.

Figures and calculations must fail to convey a correct estimate of the loss incurred by defective steam engineering; and in the case of steam shipping, the actual amount of fuel saved is only a portion, and sometimes a small one, of the saving in freight, &c., resulting from coal space available for cargo.

The astonishment expressed at the economy resulting from the use of superheated steam indicates, only too truly, how far we have departed in practice from the first principles.

The facts, that the advantages to be derived from superheated steam can be obtained at a comparatively small outlay, and that its application is easy to existing machinery, will go far to bring it into favor; but it is matter of serious doubt if an improvement that is based on the existence of a previous defect is the *best of the kind.*

The economy resulting from superheating steam must convince the most sceptical that in all engines—where the cylinders are merely clothed to prevent radiation—at least from 20 to 30 per cent. of steam is needlessly condensed during its passage from the boiler to the condenser, and it is the surplus heat supplied from the superheated steam that prevents this waste, and saves the fuel.

We are but *entering* the field of improvement in steam engineering, and the amount of duty realized from the combustion of a pound of coal is at present but a small per centage of the total value of the heat given out by that coal.

Boilers, engines, condensers, must all be greatly improved; for each

has its peculiar source of waste, the sum total of which is well known to be considerable.

We have thus, as it were, just glanced at the state of steam engineering in 1859, being conscious of omitting mention of many incidental causes for present defects. When we proceed to refer in detail to steam engine construction, the opportunity will be afforded of embracing all points of interest.

(To be Continued.)

Formula and Table for Proportioning Arches of Wood or Cast Iron for Bridges. By John C. Trautwine, Civ. Eng., Philadelphia.

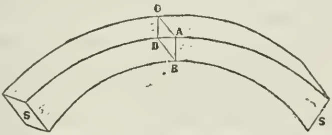
To the Editor of the Journal of the Franklin Institute.

The following formula, rules, and table, for deducing readily the dimensions of wooden or iron arches for bridges, were originated by myself for my private use; but supposing that they might occasionally prove serviceable to other members of the profession, I submit them for publication in your *Journal*, in case you entertain the same opinion.

In wooden bridges in which the entire dependence for supporting the weight of both the structure and the load, is placed upon the curved ribs or arches; the rise of which neither exceeds one-fourth, nor falls below one-twentieth of their span; the formula

$$\left(\frac{\text{SPAN}}{4} \div \sqrt{14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125}}\right) + \left(\frac{\text{RISE}}{2000}\right)$$

Fig. 1.



will be found to give the side *a b* or *a c*, Fig. 1, of a single arch of any span whatever, which is square at its crown *a c;* and which, when completed by properly increasing its cross-sectional area from the crown towards the springs, or skewbacks *s s*, (by a simple process which will soon be described,) will sustain, *besides its own weight*, (estimated at 30 pounds to a cubic foot) a uniformly distributed load of $1\frac{3}{4}$ tons per foot lineal of span; and at the same time will not, in any part of its length, be subjected to a compressive strain exceeding about 800 lbs. per square inch; in no case varying more than 10 or 12 pounds from that limit.

With so trifling a deviation from exactness as 10 or 12 lbs. in 800, the formula may therefore, so far as regards its *practical* application to bridge arches, be considered as mathematically correct.

It will be observed that the single arch derived from this formula contains the *total area* of arch at crown required for the bridge. Of

course this arch will in practice be subdivided at least into two; each of which will present half the area of the calculated single one.

The formula is manifestly applicable also to those numerous plans of bridges in common use, which consist of trusses variously framed, but depend upon a straight upper chord for resisting compressive strains. It gives the *entire* area at centre of the upper chords, for a load of $1\frac{3}{4}$ tons per foot lineal, omitting the weight of the chords.

The arch is, of course, supposed to be so braced as to resist change of form from passing loads.

About 800 pounds per square inch is the limit assigned by our most eminent designers and constructors of bridges, as the perfectly safe compressive resistance of white and yellow pines and spruce,* which are the timbers almost exclusively employed for bridge arches; and the assumption has been very abundantly sustained by experience.

According to Hodgkinson, (the most reliable authority on the subject,) the ultimate resistance of white and yellow pines and spruce to crushing, is about from 5400 to 7000 pounds per square inch; consequently our limit is but from $\frac{1}{7}$ to $\frac{1}{8}$th part of the ultimate strength.

As to their weights, white pine is somewhat lighter than the others, but inasmuch as their averages when seasoned, generally range between 27 and 33 pounds per cubic foot, we shall not affect the truth of our results appreciably, if we assume each at 30 pounds, as I have done.

The formula reduced to words furnishes the following

RULE

For arches of any span whatever; with rises from $\frac{1}{20}$ to $\frac{1}{4}$th the span.

Square the span in feet. Divide this square by 2125. Subtract the quotient from 14·6 times the rise. Take the square root of the remainder. Divide $\frac{1}{4}$th of the span by this square root. To the quotient add the rise divided by 2000.

The sum will be *a b* or *a c*, Fig. 1, in feet, for an arch of spruce or white pine; and the area *a b c d*, as well as every other cross-sectional area of the arch, will be strained about 800 pounds per square inch by the weight of the arch itself, in addition to a uniformly distributed load of $1\frac{3}{4}$ tons per foot lineal of span, after the arch shall have been so enlarged from the crown towards the springs, *s s*, Fig. 1, as to equalize the pressure per square inch in all its parts.

When the rise exceeds one-fourth of the span, the strain per square inch of area as deduced from my formula becomes sensibly less than 800 pounds per square inch; and in a semi-circular arch is reduced to about 770 pounds.

Even this *extreme* want of coincidence is an approximation sufficiently close for all practical purposes; and proves that so far as *utility* is concerned, the formula will apply to rises from as low as $\frac{1}{20}$ to $\frac{1}{2}$ the span. Rises greater than $\frac{1}{4}$th the span have not been introduced into the table however. Not only because that rise is very rarely exceeded, but because I wished to maintain a practically perfect consistency throughout its extent. As it is, it far exceeds any limits that have yet been attempted.

*White pine is in England called Weymouth pine; and spruce, white fir or deal.

Now the strain at the centre of a bridge (whether the bridge consist essentially of an arch of wood, iron, or stone; or whether its dependence for resisting crushing strains is placed in straight upper horizontal chords;) is a purely *horizontal* one; and this *horizontal* strain is *uniform throughout the arch.*

In any of the foregoing cases this *horizontal* strain may be very readily computed.*

Fig. 2.

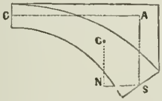
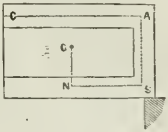


Fig. 3.



Each half of the span constitutes a lever, Figs. 2 and 3. It tends to fall by revolving on its fulcrum S, with a force represented by its weight multiplied by the *horizontal* distance *n s* of the centre of gravity G of that weight, from the fulcrum *s*, which distance is the leverage through which said weight acts. And it is prevented from falling by the counter-pressure of the other half, which acts horizontally against it at C, with a force represented by its weight multiplied by *n s*, and divided by the *vertical* distance *s a* from the fulcrum to C.

Hence the simple rule: Take one-half the sum of the entire weight of the bridge itself, and of its maximum distributed load, (making due addition for momentum.) Multiply this half sum by the *horizontal* distance *n s* of the centre of gravity G, of this half weight of bridge and load from the fulcrum or skewback *s*. Divide the product by the rise, or vertical distance *s a* from the centre of the fulcrum *s*, to the centre C of the depth of the arch or chord at the crown. The quotient will be the *horizontal* strain at C; and this horizontal strain in *the case of the arch* remains *uniform* throughout its whole extent. In the straight chord it does not; but we are not considering this subject.

In bridges of wood or iron, the distance of the centre of gravity of the half span and its load from the abutment at C, will usually be so nearly equal to ¼th of the clear span, that we shall not err materially in assuming it at that quantity, as I have done in my formula; but in stone bridges the position of the centre of gravity will be nearer the abutment, and must be ascertained previously to making the calculation. So much for the *horizontal* thrust, the only one sustained at C.

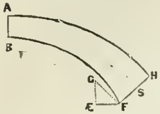
But at each skewback, or spring, *s*, the arch, sustains not only a horizontal force equal to that at the crown, but also a *vertical* one, arising from and equal to, the half weight of the bridge and its maximum distributed load, momentum, &c.

Consequently the cross-sectional area of the arch at the spring must be greater than that at the crown; and must bear to it the same ratio

* See Whipple on Bridge Building. Utica. New York, 1847; Haupt on Bridge Construction, and Bow on Bracing; both 1851; three of the best authorities on the subject.

that the resultant of the horizontal and vertical pressures at the spring bears to the horizontal pressure alone at the crown.

Fig. 4.



So long as the *thickness* of the arch remains uniform, if we take its *depth*, $a\,b$, Fig. 4, at the crown, to represent the amount of pressure at the crown, then will the depth $f\,h$ at the spring, of a properly proportioned arch, represent the pressure at the spring.

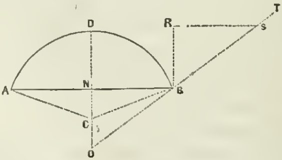
Therefore, if from the point f, we draw the horizontal line $f\,e$, equal to $a\,b$, and representing the horizontal thrust; and the vertical line $e\,g$, by the same scale, to represent the half weight of the bridge and load, then will the resultant line $g\,f$ represent both the total *amount* of pressure on the skewback, and its *direction*. And $f\,h$, drawn at right angles to $f\,g$, and equal to it, will represent the proper length and direction of the skewback joint.

The same result may be readily arrived at by calculation, thus: In any right angled triangle, as $e\,f\,g$, the hypothenuse $f\,g$, which represents the strain at the skewback, is equal to the square root of the sum of the squares of the two sides $e\,f$ and $e\,g$, which respectively represent the horizontal and vertical pressures at the skewback. In other words, if we add together the square of the horizontal pressure, and the square of the half weight of the bridge and its maximum load, and extract the square root of the sum, we obtain the entire strain at the skewback.

It is plain, that to ascertain the depth of an arch by this means, is a process of successive trials; because in order to know the strains produced in an arch, we must first know its dimensions and weight; but to obtain its dimensions and weight we must first know to what strains it is to be subjected. It is necessary, therefore, as a preliminary step, to assume certain dimensions, and from them to calculate the weight, and the strains resulting therefrom. If these calculated strains prove to be too large, or too small for the assumed arch, new dimensions must be fixed on, and a new trial made, until the required coincidence is secured.

The following very simple method of my own, possesses all the accuracy required in practice, and when used in connexion with my formula, gives the proper result at once.

Fig. 5.



Describe a small arc $a\,d\,b$; draw $a\,b$ and $n\,d$ proportioned to each other as the span and rise of the arch under consideration. In $d\,n$ continued

through the centre *c*, from which the arc was described, make *c o* equal to half of *n d*. From *o*, through *b* draw *o t*. Then is *b t* the *direction* of the skewback.

Next make the vertical line *b r* (by any convenient scale, without regard to the scale of the arc *a d b*) equal to the depth of the arch at the crown as deduced from my formula (as hereinafter explained).—Draw *r s* horizontally, intersecting *b t*. Then, *b s* measured by the same scale as *b r*, will give the length of the skewback, such that the pressure per square inch through the entire length of the arch will be the same. The *thickness* of the arch being supposed equal to the *depth* at the crown, and to be uniform throughout from crown to springs, it follows that the depth *b s* of the skewback multiplied by the thickness of the arch will give the cross-sectional area of the arch at the skewback.

It is only while thus obtaining the areas of cross-section of the arch, that it is necessary to suppose the arch to be of equal *thickness* throughout. Having once obtained the areas at crown and springs, the form into which these areas shall be thrown must depend on the judgment of the engineer, and will be affected by the nature of the material employed in the arch. If of wood, the cross-section will most probably be rectangular; but if of cast iron it will be made either **T**, **H**, or **O** shaped; or may receive whatever figure may be supposed best adapted to the peculiar case.

I repeat that the single arch found by the above process contains the *entire* area required for the bridge; and will be subdivided into two or more smaller ones, in each of which the areas at crown and springs must bear to each other the same proportions as in the large one.

The accompanying Table is intended to supersede to some extent the necessity for entering into a detailed calculation of the size of arch required in any particular case. It has been prepared from my formula. Therefore, when in any case it is found that the total weight to be supported by a wooden arch amounts to $1\frac{3}{4}$ tons per lineal foot of span equally distributed, (omitting the weight of the arch itself only,) the Table at once gives by inspection, the depth of arch at the crown; and since the thickness at that point is *supposed* to be equal to the depth, it follows that the square of the depth gives the *total* area of cross-section required at the crown. The depth at the crown being obtained, that at the skewback can be found in a few moments by employing the method illustrated by Fig. 5.

Thus, let us suppose that a single track railway bridge of 150 feet span, and with a rise of 15 feet, or $\frac{1}{10}$th of the span, has been designed, with the exception of determining upon the dimensions of arch required; and that the weight of the floor, bracing, and all other parts of the structure itself, *except the arches*, amounts to the quantity usual in such a bridge, of about ·45 tons per foot run of span; also, that the equally distributed weight of maximum extraneous load, including engine and train, snow, the effects of momentum, &c., be taken at 1·3 tons per foot run, (which I consider a fair allowance); making in all 1·75 tons per foot lineal to be supported by the arch. Now, what must be the dimensions at crown and skewback of one single wooden arch,

which by itself shall support this load safely, and not be strained in any part by a greater crushing pressure than about 800 lbs. per sq. inch?

We see at once by the Table, that the *entire arch area at* the crown must be $2{\cdot}607 \times 2{\cdot}607$ ft. $= 6{\cdot}80$ sq. ft., or $(6{\cdot}80 \times 144)$ 979 sq. ins.

Then to find the entire arch area at the skewback, describe any small arc, (3 or 4 inches long will answer very well) as $a\,d\,b$, Fig. 5, of which the chord $a\,b$ is equal to ten times the rise $n\,d$; that being the proportion in the present instance, of span to rise. Make $c\,o = \frac{1}{2}\,n\,d$; through o and b draw $o\,t$: make $b\,r$ vertically by any convenient scale, (without reference to the size of the arc,) to represent the centre depth, 2·607 feet. Make $r\,s$ horizontal; then will $b\,s$ be the *direction* of the skewback; and, measured by the same scale as $b\,r$, will be found to be 3·35 feet, the required *depth* of arch at the skewback.

Since the arch is *supposed* to be of equal *thickness* throughout, it follows that the *entire* cross-sectional area of arch required at the skewbacks is $2{\cdot}607$ ft. $\times 3{\cdot}35$ ft. $= 8{\cdot}733$ sq. ft., $= 8{\cdot}733 \times 144$, or 1257·6 sq. ins.

Consequently, the single track railway will, in this case, require two arches, each of which shall have a cross-sectional area at crown of $\frac{979}{2} = 489\frac{1}{2}$ square inches; and at skewback of $\frac{1257{\cdot}6}{2} = 628{\cdot}8$ sq. ins.

As before remarked, these *areas* may be disposed into such *forms* of cross-section as the judgment of the engineer may suggest.

At half way between the crown and skewback, measured along the chord or span of the arch, the area should be equal to half the sum of the areas at those two points; and so at any other intermediate point, a similar mode of proportioning should be observed.

Before closing this paper, I will work out in detail an example to show the correctness of the formula.

At present, I shall confine myself to explaining certain points necessary to be understood in order to render the table more generally useful in practice.

In the first place, as regards bridges whose combined weights (omitting in all cases the weight of the arches themselves,) and loads amount to more than $1\frac{3}{4}$ tons per foot lineal of span; as generally begins to be the case when the span much exceeds 150 feet.

The mode of proceeding in this case is very simple; and its principle self-evident. We have only to obtain the areas at crown and spring as if the load were but $1\frac{3}{4}$ tons per foot of span, as in the preceding example; and afterwards to increase them respectively in the same proportion as the increased total weight (omitting the arches,) per foot run exceeds $1\frac{3}{4}$ tons.

For instance, if in the preceding example, the arch had been required to sustain a weight of $2\frac{1}{4}$ tons per foot, instead of $1\frac{3}{4}$, we should have found the areas at crown and spring, precisely as was done; and afterwards have enlarged them for the $2\frac{1}{4}$ tons, thus:

Tons.		Tons.		Area at crown.		Area at crown.
1·75	:	2·25	: :	979	:	1258·6* sq. ins., for the new arch.

And,

Tons.		Tons.		Area at spring.		Area at spring.
1·75	:	2.25	: :	1257·6*	:	1616·9 sq. ins., for the new arch.

* This close coincidence was entirely accidental.

The engineer sometimes wishes to form at the moment an *approximate* idea of the size of arch required for a certain span, without the trouble of a previous calculation in detail of the dimensions and weights of the several parts of the structure; and I have endeavored to render my table subservient to this end, in the following manner.

I find by analyzing some of our best single track wooden bridges of about 150 feet span, that the weight of the structure itself (omitting the weight of the arches,) averages about ·45 ton per foot run of span; and that of this ·45 ton, about ·3 of a ton may be considered as invariable, without regard to span; while about ·15 ton increases, *per foot run* of span, nearly as the squares of the spans.

On this basis we have as the total weight per foot run of bridge and load, when the bridge is single track, and about 150 feet span, as follows (omitting the arches):—

·30 of a ton, invariable, or independent of span.
·15 of a ton, varying in other spans, nearly as the squares of those spans.
1·00 ton weight of train.
·30 of a ton allowance for momentum, snow, &c.

1·75 tons total weight per foot run of bridge (omitting the arches), and of maximum extraneous load.

Thus we see that of the 1·75 tons per foot run of a bridge of 150 feet span, only ·15 ton, or about $\frac{1}{12}$ part, must be considered as variable in calculating the weights corresponding to other spans. But inasmuch as this $\frac{1}{12}$th part increases as the *squares* of the other spans, it amounts to a serious item when the spans become very large.

In a span of 200 feet it will be thus:—

(Square of 150.)		(Square of 200.)			
22500	:	40000	: :	·15 ton	: ·222 ton,

making the total *approximate* weight per foot run of span as follows:

·3	tons	invariable weight.
·222	"	variable nearly as squares of spans.
1·00	"	weight of train.
·3	"	momentum, snow, &c.
1·822	tons	total per foot run in a span of 200 feet,

or $\frac{1}{24}$th part greater than in a span of 150 feet.

Therefore, when it is desired to ascertain *approximately*, by mere inspection of the table, the total cross section of arch at the centre of a span of 200 feet, so as not to be strained more than 800 lbs. per square inch, we must either add to the tabular *depth* its $\frac{1}{24}$th part, if we do not choose to subject the arch to a greater pressure than 800 lbs. per square inch; or we may employ the tabular depth itself in case a pressure per square inch of 800 lbs. $+\frac{800}{24}=833$ lbs. per sq. inch, is not considered too great. I say the *depth* only need be increased in making the calculation; because, as the *thickness* of the arch is *supposed* to remain uniform, the cross sectional area will increase in the same proportions as the depth.

By the same process, I find that for spans greater than 150 feet, we

must either increase the areas at crown, as deduced from the table in the following ratios, of column "depth"; or, by adopting the tabular results, subject the arch to the pressures per square inch given in column "pressure."

	Depth.	Pressure in lbs. per sq. in.
For 200 span, . . .	1·24	833
" 250 " . . .	1·7	915
" 300 " . . .	$\frac{1}{4}$	1000
" 350 " . . .	·38	1104
" 400 " . . .	·52	1216

Those, therefore, who do not consider 1000 lbs. per square inch as too great a strain, may use the tabular dimensions even for spans of 300 feet for railroad purposes. I, however, adopt Mr. Haupt's safe limit of 800 lbs.

These remarks are not intended to supersede calculation. The results to which they lead are necessarily, to some extent, incorrect; still they may be very useful when want of time prevents us from entering into a close computation, or where great accuracy is not required. We may, by this means, decide instantly upon the safety or otherwise of a bridge to which our attention may be directed; and where it is not essential to know the precise amount of strength. The ·15 of a ton per foot, which I have supposed to be *variable* in a span of 150 feet, must evidently depend in practice upon the design adopted for the bracing, &c.:—the height of the bridge—whether it is covered or not, &c.

For arches between about 100 and 150 feet span, the tabular values will be found to correspond very closely with the actual weights which occur in ordinary practice; and will need little or no modification in bridges of the usual forms of construction.

In the case of arches of *less* than 150 feet span, it would be natural to infer that inasmuch as the *variable weights* per foot run will *diminish* in such arches in the same proportion as the square of 150 bears to the square of the smaller span, therefore, the cross sectional *area* of the lesser arches themselves should diminish in the same proportions.

And if in small arches, as in moderately large ones, there were no other considerations to be attended to than their ability to resist with equal safety the simple horizontal and vertical strains hitherto referred to, such would be the case:

But in practice there are certain counteracting circumstances which render it expedient to increase rather than to diminish the proportional cross sections of arches, as their spans become shorter than about 100 ft.

It is easy to see that in the case of a 20 feet span, a very large and heavy locomotive, with the greater portion of its weight concentrated upon one or two pairs of driving wheels, and having these wheels near the centre of this short span, would be much more strained *per foot lineal of span*, than would a larger bridge having its floor covered from end to end with similar engines; and that it would consequently require a stronger arch than our assumed maximum load would assign to it.

Again, in small arches, the tabular dimensions become reduced to

such an extent, that, although they are unquestionably sufficient to sustain the deranging forces which have entered into our previous considerations; still it becomes very difficult so to arrange the shape of their cross sections as to secure the structure against the *lateral* forces to which it is exposed. And, moreover, the joints become so narrow that a very slight derangement of their parts will produce an inequality of bearing, and an undue excess of strain upon very small resisting areas, so as to endanger the splitting or splintering of the joints, and lead to the destruction of the work.

These remarks apply with peculiar force to small arches of cast iron. Suppose such an arch to have a thickness of bearing joints of but about $\frac{1}{2}$ an inch, or even less, as is very frequently the case. Here a displacement of but $\frac{1}{8}$th or $\frac{1}{4}$th of an inch, arising from any accidental occurrence, at once reduces the area of bearing surface to $\frac{3}{8}$ths or $\frac{1}{2}$ of that for which it was calculated, and renders the bridge unsafe. Moreover, when the parts become very reduced in thickness, they are too much exposed to injury from very slight blows inflicted either by evilly disposed persons or by accident.

These are not merely supposed cases;—I have witnessed them all in more than one instance; and although they are, to some extent, independent of the theoretical considerations which usually enter into the calculations for proportioning the parts of a bridge, still they are of sufficient importance to demand the attention of the practical bridge builder.

From the peculiar nature of the case, it is of course impossible to do more than assign certain arbitrary limits; leaving it to the judgment of the practitioner to vary them as he may see proper.

I can, however, confidently propose the following process, as giving, in my opinion, results which will be found satisfactory.

In arches under 100 feet span, let the cross sections, as deduced from my Rule and Table, be increased as follows:—

Divide the tabular depth by the quotient of the span divided by the rise. Multiply the quotient by 100. Divide the product by the span. Add the result to the tabular depth; letting the *thickness* remain as before.

This method gives for a span of 20 feet, with a rise of 5 feet, or $\frac{1}{4}$th of the span (and which has the smallest area comprised in the table), a depth of 1·325 feet, and a breadth of ·589 feet; or a total centre cross sectional area of arch of ·7804 sq. feet, or $\cdot 7804 \times 144 = 112 \cdot 4$ sq. ins. This will be divided into two arches, each of 56·2 sq. ins. area.

On the application of my Rule and Table to cast iron, it must be borne in mind that white and yellow pine and spruce weigh about 30 lbs. to a cubic foot, while cast iron weighs about 450 lbs. to a cubic foot, or 15 times as much.

The safe compressive resistance of white and yellow pine and spruce, is about 800 lbs. to a sq. in., or $\frac{1}{8}$th of its ultimate resistance of 6400 lbs.

The safe compressive resistance of cast iron is about 12,000 lbs. to a sq. inch; or $\frac{1}{8}$th of its ultimate resistance of 96,000 lbs. per sq. inch.; or 15 times as great as that of pine or spruce.

Therefore, a cast iron arch of the same span and rise as a wooden one, but of only $\frac{1}{15}$th the area of cross section of the wooden one, will weigh the same and be as strong as the wooden one, so far as respects its resistance to the crushing forces which we have considered.

Hence, nothing more would be necessary in applying my formula to any cast iron arches, than simply to calculate it first as if a wooden arch were intended, and then to take $\frac{1}{15}$th *the* area of cross section; but that on account of the greater brittleness of cast iron, and its inability to compress as wood does, and make close joints with equal bearings throughout, together with the reasons before assigned in alluding to cast iron arches, some increase of area is required; and I propose to use but $\frac{1}{8}$th of the area of wooden arches for cast iron ones—thus exposing the metal to but $\frac{1}{16}$th part of its ultimate crushing resistance. And I do not consider this more safe for iron bridges, than wood at $\frac{1}{8}$th of its ultimate resistance; and am confident that small cast iron bridges, calculated on the exact basis of the resistance of that metal to crushing as compared with wood, would be positively dangerous.

My Rule accords very well with several cast iron bridges of spans of about 30 feet, erected in the vicinity of Philadelphia; and which have for years borne the incessant passage of heavy engines and trains without evincing the slightest distress.

The most venturesome iron bridge of small span that has come under my notice was a city street bridge, dependent entirely upon *wrought* iron arches, 32 feet span, 6 feet rise, and 15 feet apart. Each arch presented a cross section at the centre of but $5\frac{1}{4}$ sq. inches. Whereas, my Rule gives for cast iron (which has about $\frac{1}{2}$ more resisting power than wrought,) 10 sq. inches, together with an increase to 13 sq. ins. toward the spring, which the bridge in question had not. Assuming the safe resistance of cast iron at 12,000 ℔s., and of wrought at 8000 ℔s. per square inch, which is near the truth, my Rule gives 3·7 times the strength of the bridge in question.

I have referred to these bridges of small spans more fully than I should otherwise have done, from the fact that my Rule gives results so small in comparison to the usual practice of European engineers, that its sufficiency for practical purposes might be doubted by some.

Some bridges by eminent English engineers, contain 6 or 8 times the quantity of metal that is necessary for the utmost safety; and evince either an extravagance, or a want of attention to details, that would ruin any American engineer.

Notwithstanding this waste of material, the failure of cast iron bridges of quite moderate spans is by no means an unfrequent occurrence in that country; while in the United States, no single instance of failure has, I believe, ever yet occurred. All our cast iron bridges, from spans of about 200 feet down, perform fully the duty required of them; and prove that in the *science* of that department, our engineers are not behind those of any other country. So far as my professional reading enables me to form an opinion, the bridges of Bollman in Baltimore; Murphy in Philadelphia; Haupt, Whipple, and others, evince a far nicer combination of the requirements of theory, with those of practice, than any others that have fallen under my notice.

TABLE—Showing the breadth, or the depth in feet at the crown of a single arch of yellow, or white pine, or spruce, so proportioned that when properly enlarged from the crowo to the springs, it will sustain, *in addition to its own weight*, an equally distributed load of $1\frac{3}{4}$ tons, (or 3920 pounds) per foot lineal of its span; and which load will produce throughout the entire extent of the arch, a uniform compressive strain of about 800 pounds per square inch of its cross-sectional area.

These breadths and depths at the crown are deduced from the formula

$$\left(\frac{\text{SPAN}}{4} \div \sqrt{14{\cdot}6\ \text{RISE} - \frac{\text{SPAN}^2}{2125}}\right) + \frac{\text{RISE}}{2000} = \text{either breadth, or depth at crown.}$$

SPAN IN FEET	RISE $\frac{1}{4}$ SPAN.	RISE $\frac{1}{5}$ SPAN.	RISE $\frac{1}{6}$ SPAN.	RISE $\frac{1}{7}$ SPAN.	RISE $\frac{1}{8}$ SPAN.	RISE $\frac{1}{9}$ SPAN.	RISE $\frac{1}{10}$ SPAN.	RISE $\frac{1}{12}$ SPAN.	RISE $\frac{1}{14}$ SPAN.	RISE $\frac{1}{16}$ SPAN.	RISE $\frac{1}{18}$ SPAN.	RISE $\frac{1}{20}$ SPAN.
20	·589	·657	·720	·777	·831	·881	·929	1·019	1·101	1·178	1·250	1·318
30	·722	·807	·882	·950	1·019	1·081	1·141	1·251	1·342	1·446	1·520	1 620
40	·835	·932	1·021	1·102	1·179	1·252	1·320	1.447	1·564	1·674	1·778	1·875
50	·935	1·014	1·141	1·231	1·321	1·403	1·478	1·621	1·753	1 877	1·993	2·105
60	1·025	1·146	1·255	1·315	1·449	1·524	1·623	1·779	1·924	2·062	2·190	2·313
70	1·108	1·238	1·356	1·464	1·567	1·664	1·754	1·920	2·083	2·232	2·372	2·507
80	1·186	1·326	1·451	1·568	1·678	1·782	1·879	2·063	2·232	2·392	2·544	2·688
90	1·259	1·407	1·541	1·653	1·781	1·894	1·997	2·193	2·374	2·516	2·707	2·862
100	1·330	1 485	1·627	1·758	1·881	1·998	2·109	2·316	2·509	2·690	2·862	3·027
125	1·490	1·666	1·824	1·972	2·111	2·244	2·368	2·603	2·822	3·029	3·226	3·414
150	1·637	1·829	2·004	2·166	2·321	2·466	2·607	2·866	3·111	3·313	3·562	3·774
175	1·772	1 982	2·171	2·318	2·516	2·675	2 826	3·113	3·381	3·636	3·879	4·114
200	1·899	2·124	2·328	2·519	2·699	2·870	3·034	3·346	3·637	3·917	4·182	4·439
225	2 019	2·258	2·176	2·681	2·874	3·057	3·233	3·567	3·882	4·184	4 473	4·753
250	2·135	2·386	2·618	2 835	3·010	3·235	3·423	3·781	4·116	4·443	4·755	5·059
275	2·244	2·509	2·757	2·984	3·201	3·408	3·608	3·987	4·348	4·695	5·026	5·358
300	2·319	2·630	2·885	3·127	3 356	3·574	3·786	4·189	4·571	4·910	5·300	5·651
325	2·150	2·742	3·012	3·266	3·505	3·735	3·959	4·384	4·790	5·182	5·566	5·913
350	2·549	2·852	3·135	3·100	3·650	3·892	4·127	4·575	5·005	5·421	5·829	6·231
375	2·614	2·961	3·255	3·531	3·794	4·046	4·292	4·763	5·217	5·657	6·091	6·519
400	2 736	3·065	3·371	3·659	3·934	4·197	4·454	4·947	5·421	5·890	6·319	6·804
425	2·828	3·168	3·485	3·781	4·071	4·345	4·613	5·130	5·631	6·122	6·609	7·091
450	2·916	3·267	3·595	3·907	4·204	4·490	4·769	5·310	5·835	6·352	6·865	7·379
475	3·003	3·366	3·705	4·027	4·337	4·634	4·925	5·489	6·039	6·582	7·131	7·668
500	3·087	3·462	3·813	4·143	4·465	4·775	5·077	5 664	6·238	6·809	7·395	7·960
550	3·252	3·650	4·022	4·377	4·716	5·052	5 377	6·015	6·641	7·288	7·906	8·556
600	3·412	3·831	4·226	4·603	4·967	5·325	5·672	6·363	7·045	7·735	8·439	9·168
700	3·718	4·180	4·618	5·012	5·453	5·858	6·256	7·052	7·856	8·685	9·551	10·470
800	4·010	4·514	4·996	5·166	5·926	6·381	6·833	7·749	8 691	9·685	10·750	11·910
900	4·288	4·837	5·365	5·882	6·392	6·901	7·412	8·160	9·564	10·760	12·080	13·570
1000	4·559	5·152	5·726	6·291	6·855	7·437	7·998	9·196	10·491	11 930	13·580	15·550

I will now work out an example, to show the reliability of the formula,

$$\left(\frac{\text{SPAN}}{4} \div \sqrt{14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125}}\right) + \left(\frac{\text{RISE}}{2000}\right), = \text{depth or breadth at}$$

crown for a load of 1·75 tons per ft. lineal of span, (exclusive of weight of the arch itself.)

We will take a span of 300 feet, with a rise of 50 feet, or $\frac{1}{6}$th of the span.

First to get the depth at centre.

Here $\frac{1}{4}$ the span = 75 feet.

14·6 the rise = 730 feet.

$$\frac{\text{SPAN}^2}{2125} = \frac{90{,}000}{2125} = 42{\cdot}353.$$

$$\frac{\text{RISE}}{2000} = \frac{50}{2000} = {\cdot}025.$$

$$14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125} = 730 - 42{\cdot}353 = 687{\cdot}647.$$

The square root of $14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125} = \sqrt{687{\cdot}647} = 26{\cdot}2230.$

And,

$$\frac{\frac{1}{4}\text{ span}}{26{\cdot}223} = \frac{75}{26{\cdot}223} = 2{\cdot}8601.$$

And $2{\cdot}8601 + \frac{\text{RISE}}{2000} = 2{\cdot}8601 + {\cdot}025 = 2{\cdot}8851$ feet, the *depth* as well as the thickness, at crown, as per table. Consequently, the area of the single arch at crown, is 2·8851 feet × 2·8851 feet = 8·3238 sq. feet, = 8·3238 × 144 = 1198·63 square inches; and the area at crown of each of the two small arches, into which it must be divided in practice, will be half as great, or 599·32 square inches.

My table was calculated by the foregoing process.

We must now proceed to find the weight of an arch 2·8851 feet square *throughout its length,* and the *horizontal* strain which that weight, in addition to the load of $1\frac{3}{4}$ tons per foot run of span, will produce at the centre, and throughout the entire arch.

Now, the length of an arch of 300 feet span and 50 feet rise, is 321·75 feet and its cross section *throughout* being temporarily assumed at 2·8851 × 2·8851 = 8·3238 square feet, it contains 321·75 × 8·3238 = 2678·183 cubic feet; and at 30 pounds per cubic foot, it weighs 2678·183 × 30 = 80345·49 ℔s. = 35·8685 tons.

Now, the load of $1\frac{3}{4}$ tons on every running foot of 300 feet span, amounts to 525 tons; and this added to the temporarily assumed 35·8685 tons weight of the arch = 560·8685 tons, the entire assumed weight of the bridge and its maximum load, including the allowance for momentum, &c.

The *horizontal* strain produced by this entire weight is found by multiplying one-half of it by one-fourth of the span; and dividing the product by the rise. That is

$$\frac{280{\cdot}4342 \text{ tons} \times 75}{50} = 420{\cdot}6514 \text{ tons}$$

temporarily assumed horizontal strain.

Next we must find the strain on each skewback which would result from this assumed 420·6514 tons of horizontal strain, combined with the vertical pressure arising from the assumed half weight of bridge and load, or 280·4342 tons.

As before stated, this strain will amount to the square root of the sum of the squares of these two forces, that is to

$$\sqrt{420{\cdot}6514^2 + 280{\cdot}4342^2} = \sqrt{176947{\cdot}60 + 78643{\cdot}34} = \sqrt{255590{\cdot}94}$$

$= 505{\cdot}5600$ tons temporarily assumed strain on each skewback.

Now, to find the area of the skewback, the thickness of the arch being supposed uniform; it follows that as the pressure at the crown is to the depth at the crown, so is the pressure at the skewback to the depth at the skewback; that is, as

Tons pressure at crown.		Feet depth at crown.		Tons pressure at skewback.		Ft. depth at skewback.
420·6514	:	2·8851	: :	505·5600	:	3·4674

and its area of cross-section will be 3·4674 ft. × 2·8851 ft. = 10·0038 square feet = 1440·55 square inches.

And the area at the skewback of each of the two arches into which it must be divided in practice, will be 5·0019 square feet, or 720·275 square inches.

Having thus obtained the areas at crown, and spring respectively, we are enabled to calculate the *actual* weight of the arch, as well as the *actual* pressures at crown and spring. Let us see what they are; as also whether the actual pressure on the arch is *about* 800 lbs. per square inch; and whether it is uniform throughout the length of the arch.

First, as to the actual weight of the arch.

Its cross-section at the crown is	8·3238	square feet.
And at the skewback, .	10·0038	"
	2)18·3276	"
Making its mean area, .	= 9·1638	"

Its contents, therefore, will be 9·1638 square feet × 321·75 feet = 2948·453 cubic feet.

And its weight, 2948·453 cubic feet × 30 pounds = 88453·59 pounds = 39·4833 tons.

Which added to 300 times $1\frac{3}{4}$ tons of load (or 525 tons) = 564·4833 tons of entire weight of bridge and load.

The horizontal strain resulting from this load is

$$\frac{282{\cdot}2417 \text{ tons} \times 75 \text{ ft. } \tfrac{1}{4} \text{ span}}{50 \text{ or rise.}} = 423{\cdot}3625 \text{ tons.}$$

This is the only strain sustained at the crown, where it is divided among 8·3238 square feet = 1198·6272 square inches.

Consequently, the strain per square inch at the crown is $\frac{423{\cdot}3625}{1198{\cdot}6272}$ $= {\cdot}35321$ tons = 791·19 lbs.; or *about* 800 pounds per square inch.

Finally, the strain on each skewback is composed of the horizontal strain of 423·3625 tons; and the vertical strain of one-half the weight of the bridge and its load, which is 282·2417 tons.

And it is equal to $\sqrt{423{\cdot}3625^2 + 282{\cdot}2417^2} = \sqrt{179235{\cdot}8 + 79660{\cdot}4}$ $= \sqrt{258896{\cdot}2} = 508{\cdot}8184$ tons.

And this is divided among the 1440·55 square inches of area of the skewback; giving the strain per square inch on each skewback $= \frac{508{\cdot}8184}{1440{\cdot}55} = {\cdot}35321$ tons = 791·19 lbs. per square inch, the same as at the crown.

Should the calculated weight of a bridge of the foregoing dimensions, including its load, (but omitting the weight of its arches,) be 2, $2\frac{1}{4}$, or any other number of tons per foot run, the dimensions of its arches would still be found by first employing the foregoing process as if the weight were $1\frac{3}{4}$ tons per foot; and the areas of cross-section at crown and spring afterwards increased by multiplying them by 2, $2\frac{1}{4}$, or other number of tons; and dividing by $1\frac{3}{4}$ tons.

The use of my Table is to obviate the necessity for the preceding long calculation. By means of it, for spans of 100 or more feet, the depth and area at the crown, for a load of $1\frac{3}{4}$ tons per foot lineal of span are known by inspection; and those at the spring may be deduced therefrom in a minute or two by the process illustrated at Fig. 5. It then only remains to increase them in the same proportion that $1\frac{3}{4}$ tons bear to the weight per foot run of the bridge and load that may be under consideration.

For spans less than 100 feet, the depths in the Table must be modified by the rule already given for that purpose, before they are employed in practice.

I will add, that if *double the depths given in the Table*, be taken as the *crown* depths of *stone* arches; and if then the depth at springs be found by means of Fig. 5, I believe that a much closer approximation to correct proportions will be secured than is usually done.

AMERICAN PATENTS.

List of American Patents which issued from August 16, to September 13, 1859, (inclusive,) with Exemplifications.

AUGUST 16.

170. Machines for Punching Holes in Leather; G. L. Bailey, Portland, Maine.

Claim—1st, The arrangement and combination of the bed-piece, lever, and hollow cutter, provided with a standard, connecting rod, and treadle. 2d, The arrangement of the circular adjustable cutter bed, in such a relative position to the cutter as to accomplish the object specified.

171. Sewing Machines; Wm. T. Barnes, Buffalo, New York.

Claim—1st, Working the needles vertically and alternately in the same hole in the bed-plate, in the manner set forth. 2d, The arrangement of springs, 5 and 7, wedges, finger, spring, 18, and stop, in the manner specified. 3d, The arrangement of lever, 13, slide, and lever, 12, when said lever, 12, is provided with points, is pivoted to slide, and made to operate in the manner described. 4th, The arrangement of the ratchet wheel, a, serrated bar, and ratchet, e, with the spool-rod and levers, c c′, as set forth.

172. Steam Generators; Mellen Battel, Albany, New York.

Claim—The combination with the tubes extending downward through the tube sheet or crown of the fire-box, or downward into a flue, and upward through the water above the tube sheet of the inner tubes, in the manner described.

173. Clothes Rack; T. D. Berry, Lowell, Massachusetts.

Claim—The construction of my clothes rack with divided centre, or of two sections, each to consist of centre-piece, slats, braces, and circumferential pieces, united to each other as described, when these two sections are combined with each other by plates, so hinged as to allow the rack to be folded and opened, both vertically and circumferentially, to obtain by this divided centre a rack suitable for use, when folded closely and circumferentially.

174. Sewing Machines; E. Booth, Troy, New York.

Claim—1st, The combination of an eye-pointed vibrating lever, and a looper, operating together in the manner set forth. 2d, The vibrating of the eye-pointed lever by a positive motion given to it by the rollers entirely, and as contradistinguished from the use of a spring of any kind, by which means I insure its reliable action under its rapid motions.

175. Horse Rakes; Maro Bradley, Dundee, Illinois.

Claim—The use of the recessed metal bar, spurs, rods or shoes, elastic bar, lever, slide rod, and projection, constructed and employed together, in the manner described.

176. Cabinet Furniture; J. D. Brown, Cincinnati, Ohio.

Claim—The arrangement of the folding ends, and the flaps or leaves hinged on the inside, for the purpose described.

177. Door Fastener; Henry Burt, Newark, New Jersey.

Claim—A permanent door-bolt made with the fastening plates, bolt-case, and bolt, secured and operated as described.

178. Running Gear of Carriages; Joseph Calef, Buffalo, New York.'

Claim—The journal box, constructed as described, and combined with the friction rollers or slides. Also, the combination of the axle, journal box, friction rollers, and equivalents, and hub. Also, the arrangement of the jointed braces, in combination with the running gear of carriages, for the purposes set forth.

179. Water-closet; William S. Carr, City of New York.

Claim—Regulating the action of the cock or valve in water-closets by the joint operation of the lever and weight of water in the pan, whereby the cock or valve is kept open until the weight of water in the pan regulates the closing thereof. Also, the construction of the valve, c, with the balancing diaphragm, valve, 10, and spring.

180. Machines for Dressing Stone; H. Chauncy, Perry, Georgia.

Claim—The arrangement of the pick or hammer shafts, adjustable shaft, and adjustable traverse bar, combined in connexion with the reciprocating carriage and laterally moving or adjustable bed, in the manner set forth.

181. Pipe Connexions for Steam Boilers; A. H. Clear, Providence, Rhode Island.

Claim—Making the connexions between the injection pipe, or other similarly submerged pipe of a steam vessel, or any other vessel, with the side or exterior of the vessel, by means of a valve box situated within or between the inside and outside planking of the vessel, fitted with a valve, capable of being operated by a screw, or its equivalent, by a person on or above the deck of the vessel.

182. Manufacture of Machine Belting; J. H. Clifton, New Castle, Pennsylvania.

Claim—The process of manufacturing belting for machinery from fibrous material, as described.

183. Belting for Machinery; J. H. Clifton, New Castle, Pennsylvania.

Claim—Belting made of fibrous material, by the process set forth.

184. Clover Bolts; E. K. Collins, Chili, New York.

Claim—The combination and arrangement of two bolts in clover machines, when said bolts have a counter and upward movement, produced in the manner specified.

185. Mole of Drain Ploughs; T. S. Cox, Lafayette, Indiana.

Claim—The peculiar shape of the mole, c; by the forward movement of the mole, c, the earth is carried from the bottom of the ditch by means of the terraducts, from the point of the mole, d, to the rear of the

shank, and pressed more densely by the increased earth coming in contact with the convex end of the mole, c, in rear of the shank, in such a manner as to make a better arch and more durable than any heretofore made, leaving the bottom of the ditch almost entirely uncompressed; hence, I do not claim anything except the invention of the terraducts, ending in the convex on the top of the mole, c.

186. CARPET-SWEEPER; John H. Crane, Charlestown, Massachusetts.

Claim—The arrangement of belt, rotating guides, and driver pulley, operating in combination with carpet-sweepers.

187. INDIA RUBBER SPRINGS FOR RAILROAD CARS, &c.; T. B. DeForest, City of New York.

Claim—Composing a spring of a series of blocks or segments of a circle of vulcanized india rubber, placed and held between two parallel plates, or equivalents; but this I only claim when the series of blocks are so arranged and held between the two parallel plates, that their contiguous faces shall not come in contact, under light loads, but shall come into contact and give mutual support as the load increases.

188. SWITCHES FOR RAILROADS; Thomas Dougherty, Macon, Georgia.

Claim—The combination and arrangement of the flat bars and the stationary end plates, provided with the guide rails in connexion with the rails, constructed as set forth.

189. SELF-RELEASING WHIFFLE-TREES; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—Operating the two rods simultaneously by means of the slotted guards, in combination with boxes and lips, in the manner specified.

190. ATTACHING THILLS TO VEHICLES; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The combination of the swivel coupling boxes having an elliptical slot through their ends, thill irons having fluked portions and hinged gates, or their equivalents.

191. CARPET-SWEEPER; Jacob Edson, Boston, Massachusetts.

Claim—Producing the motive power of the machine by means of a belt of rubber or gutta percha, interposed and running between the pulley or roller, and the surface to be swept or passed over. Also, arranging the guiding wheel upon the stationary hollow shaft or bushing, through which the axle of the brush shaft passes.

192. MOLE PLOUGHS; Asahel Elmer, Assignor to Nathan Elmer and Reuben M. Richard, Shabbona Grove, Illinois.

Claim—1st, In combination with the adjustable block on the plough beam, the scoring or leveling plough in advance of it. 2d, In combination with the plough beam and coulter, the swinging-weighted crane or lever, for preventing the careening of the plough, or for recovering its proper position after it has careened. 3d, The combination of a forked coulter, for cutting a wedge-shaped or tapering slice over the coulter gash, with a pressing or driving device for forcing down said slice, and thus packing the coulter gash. 4th, A mole or former made of a series of conical shaped sections, which increase in size or they recede from the coulter, and which are so linked together as that they may move in a horizontal plane, but be comparatively rigid in a vertical plane. 5th, In combination with the mole, the scorer or shoe on its rear section or end, said scorer forming a groove or channel in the bottom of the finished drain, for admitting the water into it, the sides of the drain being so closely packed as to prevent the water from entering there.

193. WHITE LEAD APPARATUS; D. R. Erdmann, Philadelphia, Pennsylvania.

Claim—A rotary cylinder, arranged with double wire nettings, in combination with a vat, provided with a tube.

194. FABRICS; Alex. Forot, Paris, France.

Claim—The manufacture of a new kind of fabric without weaving, composed simply of threads glued upon a base of paper, or any suitable kind of material, such fabric being left plain or ornamental, by embossing, or any other process.

195. SAWING MACHINE; Benjamin Fulgham, Richmond, Indiana.

Claim—1st, The combination and arrangement of the two frames, placed one within the other, and arranged so as to admit of the saws being adjusted vertically, and also moved horizontally, forward and back. 2d, The arrangement of the shafts with their respective gearing and the pulley, in connexion with the two reciprocating frames, whereby the saws are rotated, and at the same time have a reciprocating motion communicated to them. 3d, In combination with two circular saws, the inclined ways of the log carriage, for the purpose set forth.

196. MANUFACTURE OF COAL OILS; H. P. Gengembre, Allegheny, Pennsylvania.

Claim—The continual progressive and gradual destructive distillation of coal, or other bitumiferous substance, for the purpose of obtaining therefrom the different products of distillation, by means and with the use of the apparatus described, or other equivalent.

197. MANUFACTURE OF POROUS RUBBER CLOTH; Charles Goodyear, New Haven, Connecticut.

Claim—As a new porous manufacture, pervious to air and water repellant, composed of a woven or equivalent fabric, and a thin porous coating of india rubber or allied gum.

198. INDIA RUBBER FABRICS; Charles Goodyear, New Haven, Connecticut.

Claim—The porous and water repellant manufacture, composed of a bat or fleece of cotton or other fibre and india rubber or allied gum, united and rendered porous.

199. CLASPS FOR SKELETON SKIRTS; Joseph Grunwald, City of New York.

Claim—The combination of the hoops or springs with the tape, by means of clasps, constructed as described.

200. CROSS-CUT SAWING MACHINE; James Hamilton, City of New York.

Claim—The manner of arranging the shaft, d, and its gear wheel, f, and bevel gear, r, in connexion with the bevel gear, s′, and gear, s, on the shaft, l, so that said shaft, d, can be changed to stand horizontally and give motion to the saw, whether the said saw and the gearing therof be in a horizontal or vertical position, thereby adapting one machine to be moved by band, in felling trees or sawing-up logs. Also, in combination with the aforesaid machine for sawing logs, the detachable frame, buck, and variable lever, for holding smaller logs while being sawed for firewood.

201. MOLE PLOUGHS; A. Hammond, Jacksonville, Illinois.

Claim—The shoe, provided with a knife and projection, arranged in the manner set forth.

[This is an improvement on the shoe or tooth of the mole or drawing plough, and consists in extending

a portion of the tooth out behind the standard, and forming a furrow or groove in the upper surface of it diminishing, as it reaches the extreme end, for the purpose of closing up the opening left by the standard to prevent the ditch from filling up again. It also consists in forming or affixing, in any suitable way, a pin or angular-shaped knife to the sole of the shoe, to open a place along the bottom of the ditch for allowing the water to pass up into the same and be drained off from below the ditch.]

202. SELF-ACTING WAGON BRAKES; B. S Healy, Cohocton, New York.

Claim—The combination of a forked pole with the hounds, whereby the pole is free to slide in its forks and operate the brakes without moving the forks backward in the hounds. Also, in combination with brakes pivoted to a fixed bar, I claim the brake blocks, arranged and connected with the brakes, as set forth, whereby the friction of the wheels on the blocks draws the brakes toward, and causes them to press with greater force against, the wheels.

203. CAR SEATS; William M. Henderson, Baltimore, Maryland.

Claim—1st, The construction of a railway reclining chair or couch, securely attached to the floor of the car, with the whole chair reversible, so as to face either end of the car. 2d. The mode of varying the height of the back of the chair, by making it in two pieces and suspending the lower portion. 3d, In combination with a chair, reversible as aforesaid, the double-acting foot-board, single reversing leg-rest, and means for extending it by the action of the arms of the chair.

204. HOSE COUPLING; Robert Heneage, Buffalo, New York.

Claim—The arrangement of the screw sections and packing upon the cone extension, as set forth.

205. VISE; H. C. Hunt. Ottumwa, Iowa.

Claim—Constructing a vise in such a manner that it will self-retain itself upon a table or bench.

206. COTTON SEED PLANTERS; John W. Huntley. Lane's Creek, North Carolina.

Claim—The vertical rotating toothed shaft, in connexion with the follower or gatherer placed within the hopper, and arranged as set forth.

207. MILL-STONE BUSHES; Levi S. Ives, Brooklyn, New York.

Claim—1st, The placing of a cylinder, D, which contains the spindle collar, blocks, and the adjusting wedges, within a cylinder, M, secured within the centre of the bedstone, the cylinder, D, being allowed a vertical movement or play within the cylinder, M, to permit of the vertical adjustment of the spindle, and consequently the runner or upper millstone, with but little friction, and keeping all the parts in position so as to prevent their derangement. 2d, The arrangement of the plates, J K L, with the washer and ring, or their equivalent, in connexion with the projection on the inner side of the cylinder, D, to prevent the casual turning of the blocks with the spindle. 3d, The plate, N, provided with the flanch and the dome-shaped cap, P, provided with the flanch, in connexion with the cap, T, and plate, the above parts being attached respectively to the cylinder, D, spindle collar, and driver, to form an air and a dust chamber.

208. MOLE PLOUGHS; H. R. Jerome, Monroeville, Ohio.

Claim—1st, The arrangement of a beam, carrying a mole plough, with the front and rear standards of the front and rear propelling wheels, and with the adjusting device. 2d, Providing the coulter with a series of notches, and arranging the draft-chain in one or other of said notches, and thus having the draft applied directly to the coulter. 3d, The combination of a coulter which is elliptical in form in its transverse section, with a mould which is conical at its front and rear ends.

209. APPARATUS FOR LIGHTING GAS BURNERS; Wm. B. Johns, of the United States Army.

Claim—Giving the wrench staff the jointed sections, so that a match inserted in the extreme section may illuminate the burner key while the gas is being turned on, and also serve as a torch to ignite the gas.

210. WASHING MACHINE; Thomas J. Jolly, Olean, Indiana.

Claim—The arrangement and combination of the treadle, sliding table, and rotary rubber, constructed in the manner set forth.

211. MACHINERY FOR MANUFACTURING ARTIFICIAL FUEL; Morris L. Keen, Rogers' Ford, Pennsylvania.

Claim—1st, The combination and arrangement of the mills, conveyors, mixing and heating cylinders, moulding and conveying apparatus, in the manner described. 2d, The combined use of the moulding apparatus, and of the tank or reservoir of water, for the purpose of receiving and moulding the heated and plastic material in said tank of water, for cooling the machinery and fuel, and for preventing the material from adhering to the machine. 3d, The combination of the endless apron with the moulding apparatus, operating in a tank or reservoir of water, in the manner described.

212. CLASPS FOR FASTENING BANDS ON COTTON BALES, &c.; Hazard Knowles, City of New York.

Claim—The method of securing straps by means of a roller, in combination with the wedge-formed mortise of the sleeve, which receives the strap, as described.

213. CHURN; S. S. Langdon, Cleveland, Ohio.

Claim—The described construction and arrangement of rotary churns, when the same are provided with the dash frame and chambers, arranged as set forth.

214. MOLE PLOUGHS; Joel Lee, Galesburgh, Illinois.

Claim—The two swords fitting closely together, the front one attached to the mould near the forward point, the rear sword pivoted near the rear point of mould. Also, the lever, in combination with the swords for operating or adjusting the front sword and the mould.

215. STOVES; John Magee, Lawrence, Massachusetts.

Claim—The arrangement of the pot-grate, the hot air chamber, the ring grate, the register, and the ash chamber, together and with direct descending and base flues.

216. TUYERE; Joseph P. Markham, Pennfield, Michigan.

Claim—1st, The use of the indented valve, in combination with the outlet passages, arranged in such manner that, by moving said valve back and forth underneath the outlet, it will admit the wind to, or shut it off from, said outlet, equally and gradually, on each side of the central tube. 2d, The mode of making the loose nozzle independent of the masonry for support, by the use of the tube and its socket, in combination with the ribs and corresponding rebates.

217. TOWEL RACK; Rufus Maxwell, Tucker Co., Virginia.

Claim—The construction of racks for endless towels, with a slot and opening, as described.

218. Binding Apparatus for Harvesters; Charles H. McAleer, Chambersburgh, Pennsylvania.

Claim—The apparatus or elevator for raising and compressing the gavel, constructed in the manner described.

219. Rotary Movement; W. Howard Mitchell, San Francisco, California.

Claim—Two or more reversed self-detaching pawls or catches, working on opposite sides of the periphery of the ratchet wheel, by being attached to arms working in parallel lines and in the same direction, constructed as specified. Also, the combination of the ratchet wheel with the pawls or catches. and flanches, and the cross-beam, with parallel arms. Also, the combination of the ratchet wheel with the flanched casing or flanches.

220. Rotary Steam Engine; George J. Montjoy and Joel B. Sawyer, Houston, Texas.

Claim—The arrangement of the passages in the double elbow piece and the reversing cock or valve, in combination with the passages in the stationary hollow shaft and its abutment, the whole applied in connexion with the cylinder and its sliding pistons.

221. Seed Planters; Willis G. Murphy, Seguin, Texas.

Claim—The arrangement of the beam, hopper, wheels, seeding wheel, helve, plough, covers, and conductor, as described.

222. Safety-rein for Bridles; Rudolph A. Nathurst and John L. Stewart, Nashville, Tennessee.

Claim—The connexion of the choke-strap with the common or ordinary driving reins, so as to act and serve for both purposes of driving and safety-rein, and this we claim whether it be temporarily or permanently affixed to the bridle or halter, whether a bit is used or not.

223. Skeleton Skirt; Cæsar Newman, City of New York.

Claim—The combination of the jointed or hinged hoop supporters, and a series of horizontal hoops, arranged in the manner described.

224. Steam Slide Valve; J. J. Parker, Marietta, Ohio.

Claim—Placing the valves loosely on the hollow arms of the side pipe, and contracting the supply openings from the valves, for the purpose of employing the pressure of the steam to keep the valves in contact with their seats.

225. Ball Furniture Casters; John C. Pedrick, Washington City, D. C.

Claim—Inserting into a metal cup containing the ball of a caster, a separate anti-friction bearing, against which the ball revolves, thereby lessening the friction of the ball in the metal cup or socket.

226. Trucks for Railroad Cars, &c.; Thomas E. Roberts, Allamance, North Carolina.

Claim—The construction and arrangement of the concave chilled plate and convex chilled plate with each other, in the manner described, and their combination with the self-oiling friction rollers.

227. Shears; James H. Roome, City of New York.

Claim—Combining one limb of a pair of shears, or other similarly operating hand-cutting instrument, with its handle forming part of a separate lever, and combining the said limb and handle with the other limb of the shears by means of an arm attached to the said lever, and operating on the rear portion of the first mentioned limb, a link, connecting the said limb with the said lever, and a movable fulcrum connexion between the said lever and the other limb, to cause the power of the said lever to increase as the shears close.

228. Carriage and Wagon Jacks; William N. Rowe, Sharpsburgh, Maryland.

Claim—The adjustable sliding catch plate, operating in combination with the grease box and jack, as described.

229. Percussion Pellet for Fire Arms; Jacob Rupertus, Philadelphia, Pennsylvania.

Claim—The employment for enclosing the detonating compound of a metal capsule of spherical form.

230. Stoves; John Scheeper, City of New York.

Claim—The arrangement and combination of the fire chamber, ovens, and flues, as described.

231. Portable Iron Husk Grist Mills; Henry W. Shipley and Zohar Blair, Mount Vernon, Ohio.

Claim—The husk and cup, A', composed of lower and upper sections, the same being turned and fitted together, and supported upon a frame, for the purpose of making the whole portable and complete in itself. Also, cementing the stone to the interior of the cup, A, which also forms the upper husk. Also, the cup, M, constructed as described, and cementing the stone thereto, so that both will revolve together. Also, the bridge trees, in combination with the husk, cup, A', and frame, arranged as set forth.

232. Butter Worker; Henry Soggs, Columbus, Pennsylvania.

Claim—The tray, with convex bottom and ends set on an inclined plane of rollers, working in combination with the cylinder and ribs, for the purpose of working the milk and superfluous matter from the butter, at the same time leaving channels in said butter through which the milk, &c., may escape.

233. Slide Valves of Steam Engines; David Stoddard, San Francisco, California.

Claim—1st, The employment of the elastic plate, in combination with a cavity and a balance frame, as described. 2d, The combination of an adjusting spring and screw, with the elastic plate, as described.

[A flexible metallic plate is applied, in combination with a balance frame, between the back of a slide valve and the back of the steam chest, whereby the valve is relieved of unnecessary pressure, and caused to work with very little friction. This is the invention. The valve and the balance frame are constructed of a certain form, and a spring and set-screw are so applied, in combination with the flexible plate and balance frame, as to compensate for the wear of the frame, the valve, and seat.]

234. Steam Generator; William Mount Storm, City of New York.

Claim—1st, The plan or method of conveying water from a closed tank or reservoir to the heating surfaces of a steam generator by capillary attraction. 2d, So constructing and locating the said supply tank that the influence of the heat upon the water contained therein for feed, while elevating its temperature, shall in no case bring it up to the steam generating or boiling point under the given pressure.

235. Weighing Scales; Francis M. Strong and Thomas Ross, Brandon, Vermont.

Claim—The arrangement of the bars of the larger platform, to wit: one lever crossing the other at about right angles, so that the knife-edged bearings of the foot-pieces of one lever will be at right angles to those of

the other, and the lateral movement of the foot-pieces on the bearings prevented. Further, attaching the arms of the levers either separately or when connected direct to the beam, and having the bar of the scoop or smaller platform rest on knife-edged bearings on the beam.

236. Blank for Shoe-pegging Machines; B. F. Sturtevant, Boston, Massachusetts.

Claim—A blank or strip of shoe pegs cut around the log. as described.

237. Machine for Nicking and Trimming Heads of Screws; N. G. Thom, Cincinnati, Ohio.

Claim—1st, A revolving or rotating head, which revolves around a series of spindles or blank holders with an intermittent or interrupted motion, carrying upon it the necessary apparatus and tools for shaving, nicking, and trimming, or otherwise finishing the heads of screw blanks. 2d, In combination with the spindles or blank holders, the annular cam, having internal and external inclined surfaces, for the purpose of raising the spindle in the nicking process, and operating the grippers by acting upon the one rod. 3d, In combination with the spindles or blank holders, the rod, d, and spring, or its equivalent, when such a spring, or equivalent, is made to act upon the rod at required intervals, to discharge the blank, by being attached to some rotating or reciprocating portion of the machine. 4th, The lever, the spring, and catch, or other mechanical equivalent, which acts upon the machine, for the purpose of arresting one part while it releases another. 5th, The arrangement of the spindles and driving shaft in such a manner that, while the spindles containing the blanks to be shaved and trimmed are acted upon by the driving belt, the spindle containing the blank to be nicked is not acted upon, and the necessary tension is given the belt at all times in the revolution of the head without the use of a binder. 6th, In combination with the worm wheel, or its equivalent, for giving motion to the cams, I claim the cam, Y, and tool cam, X, when acted upon in such manner that the said cams remain stationary while the head revolves, or nearly so, and the cams revolve while the head is stationary. 7th, Finishing the heads of screw blanks by an apparatus, by which the necessary tools for finishing the head are revolved round the spindles or blank holders, whether such blank holders are stationary or otherwise.

238. Laying Submarine Telegraph Cables; Andrew Turney, Jr., Fairfield, Connecticut.

Claim—The construction and use of an apparatus consisting of two hollow cylinders with longitudinal joints or hinges, and two discs or flanches, set obliquely to the cylinders, and a guide or regulating disc, to be attached to a telegraph cable, while the cable is being submerged, to check the rapidity of the sinking, and to afford a constant strain on it in the direction of the vessel which is paying out the cable, to avoid kinks or festoons.

239. Washing Machines; John Wagoner and Abram Severson, Guilderland Centre, New York.

Claim—Mounting the revolving platform, K, and the pulley and gearing, or their equivalents, on the hinged platform, M, and so arranging the whole that, when M is turned up, the driving belt, O′, is slackened, and the whole lies within or by the side of the main frame—and when M is turned down, the gravity of the tub, or equivalent vessel, tightens O, and causes the several parts to operate without any labor in adjusting.

240. Carding Engines; Samuel Wethered, Baltimore, Maryland.

Claim—1st, A card-clothed main cylinder for carding engines, which performs a lateral vibrating movement simultaneously with its revolution. 2d, A card-clothed "fancy" or upper cylinder, which is capable of performing a lateral vibration as it revolves, in combination with a laterally vibrating card-clothed main cylinder.

241. Hat Measures; Julius Wehle, City of New York.

Claim—1st, The divided handle, in combination with the elastic oval strip, for the purpose of contracting the said oval strip. 2d, The scale, secured to one of the handles, and passing through an incision of the other handle, in combination with the screw.

242. Horse Power Machine; Y. B. Williams, Freeport, Illinois.

Claim—The arrangement and combination of the circular standard, toothed rim, ring, C, pinions, D, wheels, E, pinion, e, toothed ring, G, and pinion, H.

243. Machine for Bundling Kindling Wood; Wm. S. Williams, City of New York.

Claim—1st, The feeding clamps and slides, arranged and actuated in the manner set forth. 2d, The combination of the separating and dividing knife, with the concave wood carrier to convey the wood to the bundling apparatus. 3d, The sliding support, arranged to sustain the kindling wood as fed into the machine, and keep it in place. 4th, The curved gatherers, fitted and acting to deliver the bundle of wood and gather the next loose wood into a bundle. 5th, The conical gatherers, to concentrate and compress the bundle of wood. 6th, The stationary plate and segments, in combination with the conical gatherer to sustain the wood while acted upon. 7th, The plunger or press-block, acting to bring the ends of the bundle of wood level. 8th, The vertical moving frame forming the reception for the wire, and the guide for the apparatus that wraps said wire around the bundle of wood. 9th, In combination with the frame, I claim the chain to wrap the wire around the bundle of wood, and the clamp to hold the wire near the middle part thereof. 10th, The circular twisting jaws moving in dovetails, and acting, when revolved by competent means, to twist the ends of the wires together. 11th, The arrangement of the sliding and revolving shaft, in combination with the twisting jaws. 12th, The spring guides, to keep the wire straight while passed into the machine, in combination with the traveling jaw or clamp and with the shear.

244. Patterns for Moulding; John Alexander, Assignor to self and James Ritchie, Brooklyn, New York.

Claim—The employment or use of a "former," with a pattern constructed of a plastic substance, and formed on or over the "former," to produce moulds in sand for the casting of hollow ware and other castings of the exact thickness required.

245. Hanging the Bodies of Wheel Vehicles; Charles Bradfield, Assignor to C. Stewart Bradfield, Philadelphia, Pennsylvania.

Claim—1st, Attaching the wheels to the body, by means of the arms secured to the traverse bars of the shafts or arbors, which are fitted on the flanches and bearings of the plates of the body, and having springs placed between their flanches and traverse bars. 2d, Attaching the thills to the body by means of the bars, fitted in the eyes, and secured thereon at the desired height by set-screws.

246. Apparatus for Supplying Furnaces with Hot Air; Calvin Fletcher, Assignor to Addison C. Fletcher, Cincinnati, Ohio.

Claim—The arrangement of the fan and the steam chambers, A, communicating with the chambers, B C, together with the inlet steam pipes, E, the cold air passages, hot air pipes, G I I, and the pipes, F, for the discharge of the water of condensation.

247. RESTORING WASTE VULCANIZED RUBBER; Hiram L. Hall, Assignor to the Beverly Rubber Company, Beverly, Massachusetts.

Claim—The restoring of waste vulcanized rubber or gutta percha by the use of superheated steam, in the manner described.

248. COTTON PRESSES; Miles B. Hand, Assignor to self and Sheldon B. Hand, Handsboro', Massachusetts.

Claim—The combination of the toggles and screws, when the latter are connected to the driving or power shaft, or to a shaft connected therewith, by means of universal joints.

249. CHURN; John J. Lehaye, Reading, Assignor to self and John Tucker, Philadelphia, Pennsylvania.

Claim—The vessel, cylinder, and reciprocating plunger, adapted to and arranged in respect to each other, as set forth, in combination with the devices described, or their equivalents, for enlarging or contracting at pleasure the communication between the said cylinder and vessel.

250. MACHINE FOR MAKING HOOPED SKIRTS; Cæsar Neumann, City of New York, Assignor to Abraham Prince, Boston, Massachusetts.

Claim—The combination of a series of twisting apparatus with guide rods, for the purpose of forming a hoop skirt. Also, in combination with the twisting apparatus, the elevating screw and its appendages, and the mode of operating the same. Also, collapsing the guides to form different sized skirts, and to deliver the same.

251. "FIFTH WHEEL" FOR FIRE ENGINES AND OTHER VEHICLES; Robert Poole, Assignor to self and G. H. Hunt, Baltimore, Maryland.

Claim—Hanging the pivoted fifth wheel of a steam fire engine, or other heavy carriage, to a bolster when the latter plays within or over the axle of a vehicle, and is suspended to springs which have their bearings or seats on said axle.

252. MEAT SAFE; E. L. Pratt, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—A combined arrangement of a cover, perforated with small holes at the upper part, and a stand, also perforated with small holes, as specified.

253. IRON FENCES; John B. Wickersham and Henry Jenkins, Brooklyn, New York, Assignor to the New York Wire Railing Company.

Claim—Constructing railways, fences, and other articles, by metallic bars intersecting each other, and united by a cast iron ornament or connexion, when one or more bars running parallel, or in one direction, pass through between two or more bars running in another direction.

254. MODE OF LIGHTING GAS BY ELECTRICITY; Archilaus Wilson, City of New York, Assignor to D. A. Heald, A. L. Wilmarth, C. T. Martin, and H. A. Hurlbut.

Claim—Combining, with a gas or other burner, metallic points approaching but not coming in contact with each other—but this I only claim in combination with the inductive apparatus, for the purpose of effecting ignition by means of the electric discharge or spark. Also, combining with a galvanic battery, an inductive apparatus or coil, metallic points, and an electro-magnet, for the purposes specified.

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255. MACHINERY FOR FORMING HAT BODIES; Peter Arneson, Newark, New Jersey.

Claim—The arrangement and combination of the adjustable plates, perforated apron, case, feed rollers and pickers.

[The invention consists in disposing, by means of a suction blast and adjustable register, the fur on an endless perforated apron or other carrier, in such a manner that the fur will be presented to the picker and through the latter presented to the cone in a volume varying in density, and corresponding to the varying thickness of the hat body to be formed. It also consists in arranging the former or perforated cone relatively with a picker and discharging rollers, so that the former or cone will receive the fur in proper quantities without the aid of deflectors, guides, or any extraneous device whatever.]

256. SHIPPER-GEAR FOR PULLEYS; Albert Betteley, Boston, Massachusetts.

Claim—The combination of a brake lever, a friction roller, and an independent brake, applied and operating together, and with a shipping apparatus.

257. BED-BOTTOM; R. F. Billings, Portland, Maine.

Claim—The arrangement and combination of the side rails and boxes, provided with the springs, and hinged lids, and slats, attached to the lids by the straps.

258. BED-BOTTOM; A. Bingham, Talladega, Florida.

Claim—The arrangement and combination of the longitudinal slots, rocking foot rail, rising and falling hand rail, and segment guides.

259. FINGER RINGS; Seba Bogart, City of New York.

Claim—An extension or divided finger ring having its ends provided with a catch or fastening.

260. GRINDING MILLS; Charles W. Brown, Boston, Massachusetts.

Claim—1st, Regulating the adjustable stone of a grinding mill that the stone may have a vertical adjustment, so as to grind finer or coarser at the same time, so that the pressure of the runner, with respect to the stationary stone, will be automatically equalized, and be raised and lowered to free itself of any foreign substance getting between the two stones, by means of levers and vertical rod, toggles, sliding collar, and weighted arms, acting upon the movable bearing plate, or the equivalents thereof. 2d, The method set forth for regulating the flow of the grain from the hopper, by adjusting the same vertically. 3d, The dead-eye, arranged within the eye of the upper stone and capable of being raised or depressed with the spindle.

261. CUT-OFF GEAR FOR STEAM ENGINES; C. P. Buckingham, Mount Vernon, Ohio.

Claim—The employment of the tripper, arranged so as to be adjusted and to trip both valves, in combination with drops, arms, and lifters.

262. INKSTAND; William Burnet, City of New York.

Claim—The construction of an adjustable apparatus, connected with the cover and flexible bottom of an inkstand, so that at whatever height (above the lower orifice of the funnel) the link on the main reservoir may be, there shall always be a sufficiency, and never an overflow, in the funnel, on opening the inkstand cover.

263. Grinding Mills; J. Carl, Grenada, Mississippi.

Claim—1st, The arrangement and combination of the pivoted lever, shaft, stone, C, and screws. 2d, The employment of a hinged top-bar, in combination with the shaft, and stones, C D.

264. Washing Machine; H. M. Coombs and L. W. Nelson, Portland, Oregon.

Claim—The construction of the clothes' cylinder surrounded with air tubes, having orifices for discharging air into the water, in combination with the drying and washing cylinder and fire chamber.

265. Mole Ploughs; C. W. and J. H. Crandall, and Hoza N. Hawkins, Cameron, Illinois.

Claim—The combination of the opening or ditching piece with the standard and peculiarly formed, hinged follower or former, operating in the manner set forth.

266. Rat-trap; E. H. Crane, Burr Oak, Michigan.

Claim—The arrangement of the platform, spring, c, strap, spring, i, and chuck, with arms provided with projections, spring, H, and box, provided with hanging door.

267. Manufacture of Ribbed Elastic Cloth; H. H. Day, City of New York.

Claim—The method of manufacturing ribbed elastic cloth, that is to say, elastic cloth containing strands of rubber, by forming the strands of rubber upon the covering cloth, with which they are to be permanently attached, in contradistinction to forming the strands separately, and afterwards attaching the covering material to them. Also, the method of spreading the gum upon the covering cloth, and dividing it into strands at one process, so that the two operations are effected simultaneously at different parts of the same apparatus.

268. Machines for Winding Thread; Lucius Dimock, Hebron, Connecticut.

Claim—The arrangement and combination with the guide of two separate and distinct series of grooves, having their channels cut on opposite angles.

269. Composition for Cement Roofing; Joseph Ditto and Henry Van Bergen, City of New York.

Claim—The composition prepared and composed of the materials described, in the proportions set forth.

270. Nail Machines; Daniel Dodge, Keeseville, New York.

Claim—A griper, having a reciprocating movement towards and from forging or pointing machinery, and opening automatically at the outer extremity of its stroke, so as to allow the introduction of feeding forward, or removal of the rod, while it is in this position, but holding the rod fast at every other stage of its operation, and while in any other position. And in combination with a so operating griper, I claim the employment of a gauge and a cutter or cutters, operating in the described order of succession with respect to each other and the griper.

271. Writing Fluids; S. W. Eells, Mansfield, Ohio.

Claim—The manner of combining the above materials, so as to prevent the oxidation of the indigo, and the other coloring ingredients, as specified.

272. Knitting Machines; E. S. Ells, Troy, New York, Assignor to C. G. Keeney, Manchester, Connecticut.

Claim—The combination and arrangement of the lever, e, arm, pin, and slot, with lever, l, detent, and springs.

273. Elastic Bulb Syringes; J. J. Essex, Newport, Rhode Island.

Claim—So combining and arranging the bulb, air chamber, and delivery valve with each other, and with the flexible suction and delivery tubes, that the air chamber shall be above the delivery valve, and shall remain while in use, upright, or nearly so, and under the control of the hand which grasps and operates the bulb.

274. Belt Fastening; Albert Fickett, Rochester, New York.

Claim—The combination of the links with the rivets, said links being inserted in the ends of the belt, in the manner set forth.

275. Easy Chair; Elbridge Foster, Hartford, Connecticut.

Claim—The application and insertion of the quadrant slide into the centre of each of the arms or scroll of the side rail, so as to be unseen when the back is up, in the manner described. Also, the application of the spring, adjustable and extension back centre leg, in the manner described.

276. Method of Feeding the Saw to the Stuff in Sawing Machines; James F. Gamble, Concord, Penna.

Claim—Moving the saw forward when cutting, whilst the lumber is held stationary.

277. Hub-reamer; Stacy A. Garrison, Union, New York.

Claim—The arrangement and combination of the cutters and the arbor, as described.

278. Machine for Making Paper Bags; William Goodale, Clinton, Massachusetts.

Claim—1st, The pasting apparatus, consisting of the roller fitted to work in an opening in the bottom of a paste-box, the spring, or its equivalent, and the adjustable stopper, combined to operate as described. 2d, The combination of the continuously revolving measuring rollers, and the intermittently revolving feed rollers. 3d, The drop, N, operating in combination with the cutter and the feed rollers, as specified. 4th, Folding the paper around a plate or flat piece of any material narrower than the bag itself, or of the same width as, but shorter than, the bag itself. 5th, The folders, applied and operating in combination with the inclined planes at the sides of the folding table. 6th, The combination with the folding table and with a plate narrower than the bag, to fold the bag upon, of one or more movable inclined planes, and creasing blades, operating as described. 7th, The drop, Z, applied and operating as described. 8th, The bar, applied to the vibrating roller frame, and operating in combination with the knock-off.

279. Porous-napped Rubber Fabrics; Charles Goodyear, New Haven, Connecticut.

Claim—A new porous manufacture or fabric, composed of a woven or other cloth, or equivalent therefor, and india rubber or allied gum, rendered pervious to air and impervious to water, and with a face of flocks, clippings, or shearings, of woolen or other fibres, or equivalents therefor.

280. Cooking Stoves; Rensselaer D. Granger, Philadelphia, Pennsylvania.

Claim—Placing across the upper flue of a cooking stove a hollow box-formed partition, communicating with the external air, the said partition having two openings, arranged in respect to the boiler holes in the top plate, as set forth, and the said openings having their inner surfaces perforated.

281. Harvesters; John S. and Rezin Hawkins, Greenfield, Indiana.

Claim—The arrangement of the main frame and team shaft, in combination with the adjustable frame and hinged shoe or cutting apparatus, constructed in the manner described.

282. Screw Presses; Thomas R. Hopkins, Assignor to self and R. E. Robinson. Petersburg, Virginia.

Claim—The use, in combination with a power-screw of a press, or other machine, of two revolving nuts, which are fitted to gear into the thread of said screw, and so arranged and operated upon, in order to give motion to the screw, that the upper one remains stationary while the lower one revolves, and vice-versa.

[This invention consists in giving the follower of a press a progressive upward or downward motion, by means of two sets of cams, with friction rollers between them. The cams are arranged on discs, which have spur-teeth on their circumferences; the upper disc has one more tooth than the lower one. Into these teeth a long pinion gears, said pinion being moved slowly by a long lever, and as it turns, the upper disc gradually gains on the lower one, and, consequently, with the aid of the friction rollers, rises and forces up the follower with a powerful pressure, the gradual elevation being retained at all times by reason of the cams of the lower disc which has no vertical movement, acting antagonistic to the cams of the upper disc which both revolves and moves vertically up and down.]

283. Cooking Apparatus; Robert W. Hill, Naugatuck, Connecticut.

Claim—The portable cooking or heating apparatus composed of the hot air chamber and fire-pit, when provided with ports furnished with registers, with the partition and draft apertures.

284. Marine Propeller; Hermann Hirsch, Berlin, Prussia.

Claim—The peculiar form and construction of a propeller, whereby the centrifugal force obtained is made to co-operate with and increase the effect of the same.

285. Construction of Ships; Hermann Hirsch, Berlin, Prussia.

Claim—The form and construction of the hull of ships or vessels, whereby the possibility of breakage of keel is removed, and a normal form, giving a maximum of steadiness, without retardation of velocity, is imparted to the bottom.

286. Feeding Paper to Printing Presses; Richard M. Hoe, City of New York.

Claim—The combination of the feeding mechanism, cutting apparatus, and the printing machine, or their equivalents, in the said combination for feeding the paper from a roll to a printing machine, and cutting or partially cutting it into sheets, as it passes along to be printed. Also, making the cutter so as to leave the several sheets united in certain places, in combination with the conducting tapes, or the equivalents thereof, so that the conducting tapes may pass around the cutter-cylinder. Also, in combination with the cutter-cylinder and the grooved cylinders, or the equivalents thereof, the employment of the two pressure rollers, or their equivalents, for keeping the sheet distended.

287. Machines for Weighing Grain; Charles H. Hunter, Shelbyville, Indiana.

Claim—The combination of the scale beam or lever with the bag-holder secured to one end, and the standard with rack and pinion for elevating or depressing the scale beam.

288. Harvesters; Obed Hussey, Baltimore, Maryland.

Claim—1st, The combination of the main ground wheel seat and platform, when hinged to the main frame. 2d. The raising and the lowering of the entire frame, finger bar, and outside divider upon the two ground supports, in a horizontal position, by means of a lever and its connexions therewith, operated by the driver from his seat.

289. Mechanism for Protecting the Upper Part of a Boot or Shoe while Applying the Sole; Jacob Jenkins, Lynn, Massachusetts.

Claim—The arrangement of a shoe-jack (or mechanism for supporting the toe and heel parts of a boot or shoe), a guard or protector, the same being made to encompass the upper part of a boot or shoe, or so much of it as extends above the bottom surface of the last, and a clamping contrivance for adjusting the protector to the contour of the shoe. Also, the application and arrangement of an adjustable guard to the protector, whereby the fitting of the outer sole to the insole and upper is not only greatly facilitated, but is rendered certain of being fixed in its true and proper position.

290. Scales; Walter W. Kelley, Reedtown, Ohio.

Claim—The adjustable rack and platform, arranged in combination with the centre-piece upon which the rack and platform are placed, so that either one can be used at pleasure.

291. Pegging Machine; W. R. Landfear, Hartford, Connecticut.

Claim—1st, The employment, in combination with the bar, of the vertically and laterally moving box, having a plate, awl, punch, and inclined face, arranged so that on the descent of the plate the awl will enter the sole, and the inclined face will, while the awl remains in the leather, shove the bar along laterally, thus insuring certainty and regularity of feed; and on the elevation of the plate, the box will be moved laterally by the spring, the awl will be carried over the point where a new hole is to be made, and the punch brought over the previously made peg-hole in readiness to drive home the peg on the next descent of the plate. 2d, The combination with the vertically and horizontally moving box of the spring, for giving a lateral movement to said box, and the adjusting screw for regulating the spaces between the peg-holes. 3d. The arrangement and combination with the bar of the adjustable elastic plate, against which the peg block is pressed, said plate being adjusted by means of the screw to suit any size of pegs.

292. Sleeping Berths for Railroad Cars; D. L. Long, Dayton, Ohio.

Claim—The arrangement and combination of the jointed supporters and hinged seat and back, with the folding berth, screen, and rest, arranged so as to form two sleeping berths, as described.

293. Alloys; Eugene Martin, Waterbury, Connecticut.

Claim—The process or mode of procedure, as applied to the ingredients, such as described.

294. Pumps; John M. May, Janesville, Wisconsin.

Claim—The cylinder, in combination with part, A, arranged and operated with piston and pipe, as described. Also, the screw, D, when used for the purposes of fastening and unfastening the stationary part of the pump in the well or reservoir to any suitable substance, as described. Also, set-screw, N, in combination with the notch or projection, or their equivalents, to form a catch or wrench, for turning the screw, D, and pump nearly in the path of a horizontal circle, in fastening and unfastening the stationary part of the pump in the well or reservoir, the set-screw also serving to gauge the descent of the piston and to protect the valves from injury. Also, the devices consisting of the springs, segment, and lever, connected together, as described.

295. Pumps; John M. May, Janesville, Wisconsin.

Claim—The device for connecting together the cylinders, and regulating the stroke of the pump, in com-

bination with the point or spike, or its equivalent, when used in open wells, and said device in combination rod, when used in drilled wells. Also, the collar and springs, when used in combination with the pump or with the eduction pipe, and arranged as shown.

296. Argand Gas Burners; Hippolyte Monier, Paris, France.

Claim—The construction of the Argand burner, with its grate and external tube of clay, porcelain, or other incorrodible, refractory, non-conducting material, and with the inner tube and stem of metal.

297. Corrugated Iron Bridges; Richard Montgomery, City of New York.

Claim—1st, The combination of the corrugated arch, A B, with the corrugated arch, M N, arranged in relation to each other. 2d, The combination of the peculiarly formed blocks, C, and bed-plates, F, with the abutment ends of the arches, A B and M N. 3d, The combination of the blocks, D, and bottom plates, G, with the cross-rails and arches, A B and M N.

298. Ladies' Bustles; Benjamin F. Moore, City of New York.

Claim—An inflated bustle for ladies' dresses, formed with the projecting points or scollops, in the manner specified.

299. Mode of Measuring Grain; Daniel Murray, Fairfield, Connecticut.

Claim—The arrangement of the arms, in combination with the sides, constructed as described.

300. Stamping Machines for Crushing Ores, &c.; Wm. Murray, Baltimore, Maryland.

Claim—1st, The combination of two or more stampers arranged on the same radial line with two or more semicircular, inclined, revolving, lifting, and dropping cams, which move together, and with a central driving shaft. 2d, Providing the semicircular lifting and dropping cams with a vertical joint about midway between their terminating ends, and with an oblong vertical slot at their rear or highest ends, and attaching said ends, by means of a set-screw, or its equivalent, to the frame of the cams, so that the inclination of said cams may be adjusted to lift the stampers to a greater or less height, according to the force required to perform the operation of stamping.

301. Reciprocating Saw; Richard H. Osgood, Columbus, Ohio.

Claim—Providing the upper edges of saw teeth with notches, as described, for the purpose of assisting to clear the kerf of sawdust.

302. Hoisting Apparatus; John L. Pott, Pottsville, Pennsylvania.

Claim—The inclined drum, revolving in a plane parallel, or nearly parallel, to the lines of hoisting rope, in combination with the guide pulleys on the cross-head, the latter being operated by the shaft or the drum through the medium of the screw, or its equivalent, as set forth.

303. Tapping Water Mains; John B. Quigley, Trenton, New Jersey.

Claim—The employment of the pivoted standards, jaws, adjustable beam, adjustable swivel, chain, vertical sliding piece, and ferule, as described.

304. Inkstand; Thomas Robjohn, City of New York.

Claim—The arrangement and combination of the ring, D, cover, arm, slatted projection, and diaphragm, so that by pressing down ring D, the cover will open and the ink rise; and by releasing the ring, the ink will fall and the cover will close.

305. Method of Shaping Bonnets; Charles W. Russell, Philadelphia, Pennsylvania.

Claim—The method of shaping bonnets, &c., by means of a core, or its equivalent, which is wound over the several parts of the bonnet, and which is retained in position by hooks, or their equivalents.

306. Machine for Pressing Bonnets; Charles W. Russell, Philadelphia, Pennsylvania.

Claim—The arrangement of the adjustable roller, or its equivalent, in such relation to the chain or rope, which connects the treadle with the press lever, that the direction in which the pressing iron acts can be controlled.

307. Rotary Engines; Augustin P. Samuel, City of New York.

Claim—The method of governing and working the pistons by connecting their piston rods through the roller holders and rollers, directly with the eccentrated curve. Also, the combination and arrangement of the valves with and within the movable pistons, whereby such valves are opened by the first motion of the piston rods, and before any motion is given the pistons, so that a passage is given to the steam within such pistons, and the steam admitted on both sides thereof for the purpose of producing an equilibrium of pressure on each side of such pistons before they are put in motion. Also, the construction and arrangement of the packing rings acting against each other by inclined surfaces; the outer ring being conical or tapering, on both sides, and the inner ring, being tapering on one side only towards the ring, and the inner ring acting against the other by means of the spring, or its equivalent, expanding it outward against the cylinder, and inward against the piston.

308. Mortising Machine; Hezekiah B. Smith, Lowell, Massachusetts.

Claim—The relative arrangement of the fulcrum, lever, connecting rod, and table, with each other, when combined with power mortising machines.

309. Stoves; George S. G. Spence, Boston, Massachusetts.

Claim—The use of the conical inverted cup, combined with the chain, or its equivalent, in the manner set forth. Also, the combination of the air deflector with the fire-place door register, and so as to operate therewith, and deflect the entering currents of air upon or toward the ignited surface of the fuel.

310. Sewing Machines; Orange N. Stoddard, Oxford, Ohio.

Claim—The yielding metallic loop-check, operating in combination with a grooved hook, or its described equivalent, in the manner set forth.

311. Animal Trap; Zuriel Swope, Lancaster, Pennsylvania.

Claim—1st, The sinking bottom, constructed for closing the trap, when acting in combination with the spring and bait lever. 2d, The counterbalance chamber, constructed as described, and operating for the purpose of re-setting the trap.

312. Gas Retorts; H. K. Symmes, Newton, Massachusetts.

Claim—The arrangement of the removable flues and valves, in combination with retorts of double length.

[This invention consists in arranging the lid of a retort with a horizontal tube or flue in such a manner

that the flue can easily be removed and cleaned independent from the retort, and it further consists in arranging it with a socket to fit to a flanch which is cast, or otherwise rigidly attached to the lower end of the stand pipe, so that the lid can be attached to the body of a retort, dispensing with the mouth-piece altogether; and that the gas emanating from the material in the front part of the retort has to pass back over the hotter portion of the coke in order to reach the opening in the flue through which it passes to the stand pipe, and the stand pipe is secured to the body of the retort, so that its lower end is open when the door is taken off. If this arrangement be applied to retorts of double length, the openings of the flues are closed by valves which are operated from the outside, and the two ends of the retorts are closed at different times, so that one end is hot while the other is charged, and by closing the flue on this end, the gas arising from the fresh charge can be forced to pass through the whole length of the retort to the flue on the opposite end.]

313. Ticket-holder for Railroads, &c.; Charles Taylor, Little Falls, New York.

Claim—The eye, spring clasp, and spring hook, in combination with the link, or its equivalent.

314. Preparation of Candlewicks; Stephen R. Weeden, Providence, Rhode Island.

Claim—A plaited or braided candlewick, saturated with a solution of acetate of lead, or other substance, to aid combustion, and coated with a silicate, as and for the purpose set forth.

315. Railroad Chairs; J. W. Wetmore, Erie, Pennsylvania.

Claim—The T lip or jaw, notching the web of the rail, and through these notches, having the bottom of the jaw pass down, and riveted or keyed under the base.

316. Water-wheels; Ira Wisel, Newbury, Minnessota.

Claim—The peculiar form of the buckets, in combination with the rest of the wheel.

317. Knitting Machines; F. L. Buel, Assignor to C. G. Keeney, Manchester, Connecticut.

Claim—Attaching the mechanical device, above set forth, to a knitting machine, namely, by the thread guide, lever, c e, and arm. Also, the arrangement of the lever, k, connexions, frame, and arm, as described.

318. Sewing Machines; Jonas Hinkley, Assignor to self and Frederick A. Wildman, Clarksfield, Ohio.

Claim—1st, The combination of the looper and receiving spring hook, arranged in the manner set forth. 2d, The combination of the deflecting hook, the looper, and the receiving hook. 3d, The lifting finger, or its equivalent, operating as set forth. 4th, The combination of the lifting finger with the looper and receiving hook, as described. 5th, The combination of the lifting finger, the deflecting hook, the looper, and the receiving hook, as described. 6th, The combination of the arm, link, and lifting bar, with the vibrating bar and feeding hand, for the purpose described.

319. Cam Presses; Thomas R. Hopkins, Assignor to self and R. E. Robinson, Petersburgh, Virginia.

Claim—Operating a press follower, or other part of a machine which is required to give a gradual pressure, by means of the combined agency of two differentially toothed discs, which revolve at unequal speeds, two sets of reverse acting cams and intermediate friction rollers, or their equivalents.

320. Machinery for Making Clay Pipe; Wm. Linton, Assignor to self and John Jones, Baltimore, Md.

Claim—The two-sized permanent core or mandrel, in combination with the fixed die and adjustable jaws, arranged in the manner described.

321. Quartz Mills; E. T. Steen, San Francisco, Assignor to self and B. S. Nichols, Sacramento, California.

Claim—The employment of stampers, opereted by means of steam cylinders, which communicate by the cross-passage, the change of steam being effected by valve pistons operating on a working beam, and operated by the pistons.

322. Manufacture of Iron; Bernard Louth, Assignor to Jones & Louth, Pittsburgh, Pennsylvania.

Claim—Rolling iron or steel in a cold state for hardening and adding strength to it, without injury to its fibre, and at the same time reducing it in size.

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323. Lozenge Machines; Edmund Belling, City of New York.

Claim—The combination of a revolving or reciprocating knife with the lower part of a press, and operated simultaneously with the same, in the manner described.

324. Horizontal Water-wheel; Abraham Andrews and Harrison Kalbach, Bernville, Pennsylvania.

Claim—The curved concave buckets, having curved or eccentrically formed tops and bottoms, in combination with a spiral water-way or chamber underneath, and arranged within a box, as described.

325. Artificial Legs; Douglas Bly, Rochester, New York.

Claim—1st, The combination of the segment of rubber, or its equivalent, with the foot and leg, in the manner described. 2d, Connecting the foot to the leg, by means of the cord, or its equivalent, thereby dispensing with all joints, bolts, hinges, and metal straps, and the friction and noise to which they give rise.

326. Elastic Hose Tubing; J. C. Boyd, Boston, Massachusetts.

Claim—The hose made of flexible tubes, the same consisting of a woven fabric of cotton, hemp, or other fibrous materials, lined with or fastened to a layer or sheet of india rubber or gutta percha, or any other water-proof composition, and the whole secured by rivets.

327. Iron Ties for Cotton Bales; William Boyd, New Orleans, Louisiana.

Claim—In combination with the splits, the use of a key, having wings at each end, to form the lock to the tie, arranged as set forth.

328. Tanning; Jehu Brainerd and W. H. Burridge, Cleveland, Ohio.

Claim—The improvement in tanning set forth, consisting in the immersion of the skins and hides in a tan liquor made from the digestion of the before-mentioned plants, and the accompanying treatment of the skins and hides, by their immersion in the preparing liquid, the whole process being conducted in the manner set forth, whereby the valuable properties of the plants may be preserved for use—and this we claim, whether the above described tan liquor be used separately, or in connexion with other substances containing tannin.

329. Gold Amalgamators; Henry Brevoort, San Francisco, California.

Claim—The drag, having upon its lower surface or shoe the combination of the blocks of rubbing sur-

faces and channels, the two being arranged reciprocally in the manner described. Also, combining with a revolving drag, a pan, whose bottom is inclined, and has the form of a circular trough, so as to collect the mercury in mass. Also, combining an amalgamating pan and revolving drag with a galvanic battery, arranged in such manner that its poles are extended into the mass of material in the pan, and that the parts of the material are subjected in succession to the action of the galvanic current. Also, the employment of a solution of the nitrate of mercury in connexion with a galvanic battery and a friction amalgamator containing mercury.

330. Quartz-crushing Machines; Henry Brevoort, San Francisco, California.

Claim—The relative arrangement and combination of the curved grinding shoes, having their front edges beveled and inclined backwards from their outer corners, and caused to revolve so as to gather in and return the coarser fragments towards the centre of the series. Also, the arrangement and combination of a series of grinding shoes, with their front edges curved or inclined backwards, with a corresponding inner series of reducing shoes, so that the coarser fragments are re-delivered in an inward direction to the reducing shoes, while the grinding and outward movement of the fine particles proceed continuously.

331. Gun Lock; William Briggs, Norristown, Pennsylvania.

Claim—Constructing the stock and breech of the barrel, so as to be susceptible of and united to each other by the tang or breech-pin and tapering screw-pin, and the spring hammer-guard and trigger, arranged and combined with the stock, in the manner set forth.

332. Water Metre; B. S. Church, Manhattanville, New York.

Claim—1st, The arrangement of a drum with the chamber and buckets, in combination with the trough and air chamber, and operating as set forth. 2d, The arrangement and combination of the trough, the pipe, the chamber, the air chamber, and the drum, to operate as specified.

333. Carriage Springs; H. S. Clark, Wyalusing, Pennsylvania.

Claim—The arrangement and combination of the U-shaped leaves with the elliptical springs, so that the extremities of the leaves will approach each other, and will be secured to the centres of the springs.

334. Washing Machines; F. J. Crissey, Leesburg, Virginia.

Claim—The arrangement of frame, supports, i i, upright shaft, rollers, supports, c c c, and collar, in combination with the bottom of the tub, arranged as set forth.

335. Valve for Steam Engines; Addison Crosby, Fredonia, New York.

Claim—The employment, as an induction or eduction valve in a steam engine, of a rolling or oscillating valve, composed of two segments, having their faces eccentric to its axis of oscillation, and with an opening between the segments.

336. Elastic Cloth; Horace H. Day, City of New York.

Claim—The new elastic cloth, consisting of stockinet cloth, elastic gum, and flock, combined so that the elastic gum is covered on one side by the stockinet, and so on the other by the flock.

337. Scroll-sawing Machine; Samuel De Vaughan, Washington City, D. C.

Claim—The vertical plates, g, and guide blocks, plates, m and m′, and guide arm, for the purpose of a compound guide. Also, the manner of operating link on bearing, in combination with block and guide arm, for the purpose set forth.

338. Harvesters; J. A. Falk, Andrew Johnson, and G. A. Erickson, Altona, Illinois.

Claim—The arrangement of the wheel, which is provided with the pin near its periphery, with the bar and pulley, constructed for the purpose of operating the band which drives the endless belt.

339. Ophthalmic Vapor Apparatus; T. F. Frank, Ischua, New York.

Claim—The ophthalmothological vapor bath, constructed and operating as described, for producing medicated vapor.

340. Faucets; Albert Fuller, Cincinnati, Ohio.

Claim—Encasing an elastic plug valve in the above described metallic shield, for the purpose set forth.

341. Machine for Cutting and Screening Bituminous Limestone or Asphalt; Quincy A. Gilmore, City of New York.

Claim—1st, The rotary cylinder or drum, carrying knives or cutters of the form described, arranged in rows, either with or without the raised bands, or in rows parallel or oblique to the axis of the cylinder, for cutting asphalt, sometimes known under the name of bituminous limestone. 2d, The application of the machine as a whole, to the purpose of cutting and screening asphalt or bituminous limestone.

342. Cord Guides for Sewing Machines; A. Golay, Mobile, Alabama.

Claim—The arrangement and combination with the adjustable plate, of the groove and guides, so that the cord may be guided and conducted between two or more thicknesses of cloth.

343. Flour Bolts; Elias Graham and I. N. Patton, Elizabethtown, Kentucky.

Claim—The combination of the wedged sliding ribs with the rods and screws for adjusting the same, in the manner set forth.

344. Billiard Cue-tip; J. H. Green, Christiansburg, Iowa.

Claim—A tip or point for billiard or bagatalle cues, made of any compound described, so as to dispense with the external application of chalk, or other substance, to the point of the cue.

345. Hollow Grate-bar for Steam Boilers; Benjamin L. Griffith, Reading, Pennsylvania.

Claim—Two or more tubes attached to hollow boxes connected to the fire-box, by means of hollow perforated screw plugs, and arranged in sets to complete the grate.

346. Breech-loading Fire Arms; Henry Gross, Tiffin, Ohio.

Claim—1st, Giving the chamber its longitudinal motion upon a bed-piece, which remains fixed during such motion, and in revolving carries with it the chamber. 2d, The roller, or its equivalent, upon the cheek-piece, and its combination with the groove. 3d, The double eccentric head of the lever, when connected with the chamber and bed-piece. 4th, The adjustable bearing piece for the eccentric of lever.

347. Fastening for Hoop Skirts; Albert W. Hale, City of New York.

Claim—The method of connecting and fastening the ends of the hoops by means of the cap, one part of such cap, with the end of the hoop, forming a point or extension to enter a recess in the cap on the other en

of the hoop; and such cap also furnishing the recess to receive the said points or extension of the other end of the hoop, when the cap and hook are bent, in the manner described.

348. Escapement for Chronometers; William W. Hammond, City of New York.

Claim—The employment of the hollow semi-cylinders on the vibrating lever, in combination with the escapement wheel, and the balance and verge. Also, in combination with the escapement, as described, or any equivalent therefor, the employment of the holding spring.

349. Sewing Machines; James Harrison, Jr., City of New York.

Claim—1st, The combination of the frame or feeding lever, j, bar, m, spring, o, and regulating screw, p, with the needle and needle frame for carrying the mechanism for rotating the needle. 2d, The adjustable bar or band affixed to the lever or frame, j, in combination with the frame, i, for controlling the upward movement of the feed lever. 3d, The bar or band, in combination with the bar, m, screw, p, spring, o, and lever, j.

350. Bed-bottom; Royal Hatch, Strafford, Vermont.

Claim—The arrangement of a central supporting bar with a sacking, both provided with double loops, and attached respectively to the bedstead.

351. Springs for Railroad Cars, &c.; Alexander Hay, Philadelphia, Pennsylvania.

Claim—1st, The construction of vulcanized india rubber springs, in which the threads, or warp, or fabric out of which they are formed, is made non-elastic before it is woven or knit. 2d, In combination with india rubber springs, to be acted on by tension or stretching, I claim the tubes with their flanches. 3d, In combination with the springs, acting as described, I claim the supporter with the opening in each end, and holes for tightening the spring.

352. Metallic Razor-strop; Milo A. Holcomb, Granby, Connecticut.

Claim—A razor-strop made of polished steel of the requisite degree of hardness, when possessing a sufficient degree of flexibility to enable the angle at which its surface forms with the edge of the razor to be lessened to the desired extent.

353. Machinery for Winding Warps upon the Beam; Daniel Hussey, Nashua, New Hampshire.

Claim—The peculiar combination for maintaining uniformity of wind, or surface speed of wind, on the yarn beam, the same consisting of the friction wheels, the lifter rack, the pinion, and the compound motion mechanism, or their mechanical equivalents, applied to the yarn guide rollers, and the mechanism for adjusting the yarn beam, in manner specified.

354. Furnaces for Smelting Zinc Ores; Joseph and Isaac Kalbach, Bernville, Pennsylvania.

Claim—Constructing the crucible with a detachable bottom, and attaching it to the arch of the cylinder or collar and to the bed-plate, by the rings or annular plates, whereby we are enabled to empty the crucible at its bottom, and to remove the entire crucible through the bottom or the arch of the heat chamber, as may be required.

355. Machines for Holding Stones; Ebenezer B. Knight, Malden, New York.

Claim—Providing the stone-holding machine with the suspending arms, plates, rod, and adjusting bolts, or their equivalents, whereby said machine may readily be adjusted vertically and also horizontally, in the arc of a circle.

356. Wind-mill; Charles Livingston, Redwood City, California.

Claim—The cowl, with tubes and wheel combined and arranged for joint operation, as set forth.

357. Chute for Horizontal Water-wheels; Isaac Mallory, Etna, New York.

Claim—Constructing and arranging the scroll within the penstock, so that it can be turned, so as to partially close the orifice for the admission of water upon the buckets, and to thereby regulate the flow of water for any head, or for any quantity of water.

358. Curing and Treating Caoutchouc; E. E. Marcy, City of New York.

Claim—The improved process of curing india rubber by combining with the sulphuret of lead and carbonate of lead, or the protoxide of lead, in the manner hereinbefore described, and without the use of free sulphur, in combination with the rubber or with said compound, and the exposure of these compounds to steam or water at the temperature hereinbefore stated, and in the mode pointed out.

359. Curing and Treating Caoutchouc; E. E. Marcy, City of New York.

Claim—The improved process of curing india rubber by combining it with the sulphuret of zinc and the hyposulphite of zinc, in the manner hereinbefore described, and subjecting the compound to steam and water, at the temperature stated, without the use of free sulphur, in combination with said compound.

360. Curing and Treating Caoutchouc; E. E. Marcy, City of New York.

Claim—The improved process of curing india rubber, and producing an improved article of india rubber, by combining india rubber with the hyposulphite of zinc, in the matter hereinbefore described, and without the use of free sulphur, in combination with the rubber, or with said compound, and the exposure of this compound to steam or water, at the temperature hereinbefore stated, and in the mode pointed out.

361. Machines for Picking Mill-stones; R. D. Nesmith, Franklin, New Hampshire.

Claim—The spring upon rod, provided with head for limiting the extent of its action upon the picks, as arranged with the inclined plane and cam, and the operating parts with which they are connected, in the manner specified.

362. Apparatus for Manufacturing Illuminating Gas; Samuel Nowlan, City of New York.

Claim—The gas exhaust and expelling wheel, interposed between the retort and the condenser, so as to operate in the manner set forth.

363. Apparatus to Photograph on Uneven Surfaces; John H. Pein, Hoboken, New Jersey.

Claim—Photographing on vases, or other uneven solids, by means of an apparatus herein described, and in the manner set forth.

364. Gelatinizing Oils; Edmund Queru, City of New York.

Claim—The jellification of castor oil by means of the process described.

365. Tinman's Machines; Charles H. Raymond, Southington, Connecticut.

Claim—The movable and adjustable stand and its revolving box, when combined with shaft, cap-plate, and screw, in the manner described.

366. FURNACE AND VENTILATOR; Charles B. Sawyer, Fitchburgh, Massachusetts.

Claim—Providing the fire-pot with a series of small holes or openings, as set forth.

367. ORE CONCENTRATOR; Edward L. Seymour, City of New York.

Claim—1st, The rotating sieve, in combination with the bellows, or their equivalents, operated by the act of rotation of the former. 2d, The application of two or more rotary sieves, combined with such an arrangement of "waste tubes," that the refuse of the upper sieve shall be led to constitute the supply or feed of the sieve next below it. 3d, Rendering the receiving mouths of the "waste tubes" adjustable. 4th, The use of the closed chambers or "traps" below the sieves, as described.

368. COMPOSITION FOR DESTROYING INSECTS INJURIOUS TO FRUIT TREES: Philo B. Sheldon, Prattsburgh, N. Y.

Claim—Combining and employing the ingredients herein described, in substantially the mode and proportions set forth, for the purpose of destroying borers, and other insects on fruit trees.

369. LETTER FILE; J. H. Shipman, Yorkville, New York.

Claim—The arrangement of the movable hinged guards, in combination with the metal back and points, as described.

370. HOSE COUPLING; William H. Smith, Newport, Rhode Island.

Claim—The hose coupling described, made by combining the open spiral flanch with a screw, as set forth.

371. STOVE URNS; James Spear, Philadelphia, Pennsylvania.

Claim—The arrangement of the register in the base of the urn, with the ornamental receptacle for the cup, constructed in the manner described.

372. CHURNS; A. L. Sperry, Auburn, Indiana.

Claim—The arrangement of the hook and button, to operate in combination with the dasher and breaker frame, in the manner specified.

373. ROTARY PLANING CUTTER; Henry D. Stover and J. W. Bicknell, Boston, Massachusetts.

Claim—The adjustable revolving guard, as constructed and connected adjustably to the cutter head, carried by and having all its movements to effectually protect the operator from mutilation, and to hold down the material receiving shape, in the manner set forth.

374. STONE SAWS; Peter Sweeney, Buffalo, New York.

Claim—The employment of two plates, in combination with the dish-formed cutter, arranged as described.

375. SHINGLES; Joseph Sweetser, Biddeford, Maine.

Claim—The fluting of the shingles.

376. AUGER FOR CUTTING ROUND TENONS; George Taylor and George H. Burger, Worthington, Ohio.

Claim—The arrangement and combination of the spring with the shank and tube, as described, whereby the plug is rendered self-acting.

377. FEED-WATER APPARATUS FOR STEAM BOILERS: Joseph B. Thompson, Warrenton, Georgia.

Claim—The exterior water chamber, communicating with the supply tank by pipe, and with the boiler by force pump and pipe, and provided with a valve, in combination with the peculiarly constructed float, rods, and lever, operating as specified.

378. FIRE-PLATING IRON; William H. Thoss, San Francisco, California.

Claim—Preparing the iron after it has been cleaned with dilute acid, by immersion in a solution of borax, and after being dried, passing it through the molten copper, maintained at the required heat in a furnace, constructed with a roof to concentrate the heat over the basin of molten copper, and with an aperture at one side to insert the iron to be plated, and a corresponding one on the opposite side, to receive the iron as it is drawn from the copper plate, as described.

379. HEMP BREAKERS; William A. Vertrees, Winchester, Missouri.

Claim—Constructing the rocking breaker frame of hemp or flax breakers, in the manner described, and operating it by means of a slotted pitman, in such manner as that while the vibratory motion is communicated from the prime motor to the breakers by machinery, yet they fall on the hemp or flax with a free stroke or flail motion.

380. SHINGLE MACHINE; Nathaniel Waterbury, Fond du Lac, Wisconsin.

Claim—1st, The reciprocating bolt carriage, tilting beds, circular saw, and sliding jaws, arranged relatively with each other as shown, and operated respectively by the cam, cam ratchets, and pendants, belt, and levers and weights. 2d, In connexion with the reciprocating belt carriage, saw, and tilting beds, the bar, provided with inclined slots, and connected with the frames of the jaws, by means of the pins fitting in said slots for the purpose of elevating the bolts during their return movement. 3d, The employment or use of the cam ratchets attached to the framing, in connexion with the pendants attached to the reciprocating bolt frame, arranged for automatically tilting the beds.

381. MACHINE FOR COILING METAL PIPE; Peter L. Weimer, Lebanon, Pennsylvania.

Claim—1st, The coiling cylinder with the peculiar shaped groove, arranged as described. 2d, The arrangement of the two guide wheels, triangular piece, and shaft, when used in combination with the coiling cylinder, and for the purpose described. 3d, The movable plate and jack-screws, for the purpose of adjusting the guide-wheel shaft to any angle required.

382. SKATES; Asa Wheeler, Brattleboro', Vermont.

Claim—The arrangement and combination of the adjustable heel-piece, heel-case, stock, screw, and front straps, as described.

383. FEED-WATER HEATERS FOR STEAM BOILERS; John M. White, City of New York.

Claim—The arrangement of the division chamber, supply and discharge pipes, and heating pipes, placed within the exhaust side pipe, in combination with the relief pipe, by which, when necessary, the water may be passed directly to the boiler without being passed through the heating pipes.

384. HARVESTERS; Abner Whitely, Springfield, Ohio.

Claim—1st, So arranging the mechanism of the automatically operating door or shutter, for preventing scattering and admitting the gavels to be discharged at regular intervals, as to permit the attendant to increase the intervals of time for the discharge of the gavels where the grain is thin upon the ground. 2d, The

combination of the rake with the door or shutter. for discharging the gavel at the time the door or shutter is opened for the purpose, whether it is at regular intervals or less frequently.

385. Shears for Separating Paper; Jeptha Avery Wilkinson, Brooklyn, New York.

Claim—1st, Separating paper, or other material, by the joint operation of a revolving shear and a stationary surface, when said stationary surface is so formed and placed as gradually to approach the path described by the shear in its revolution, and compress the said paper, or other material, on to the edge of said revolving shear, in the manner specified. 2d, The elastic roller or rollers, in combination with the stationary surface and revolving shear on the cylinder, whereby the paper is passed through and separated progressively as at two operations. 3d, The arrangement of the shaft carrying the rollers, the springs, and cams, for elevating the rollers and preventing traction on the paper.

386. Turn-outs for Railways; Frank C. Brown, Assignor to Wm. Brown, Philadelphia, Pennsylvania.

Claim—The addition of grooves on the circumference of car wheels, as now constructed, with a single flanch and tread, and the placing of curved bars at turn-outs on the track of the road, to enter and operate on such grooves for the purpose of changing the direction of cars.

387. Machinery for Hardening Hat Bodies; Seth Boyden, Assignor to self and H. H. Jacques, Newark, New Jersey.

Claim—1st, The employment of a cloth, or its equivalent, in combination with a cone, in the manner described. 2d, The arrangement and combination of the frame, shaft, J, eccentrics, h′, rods, i, tubes, arms, shaft, K, eccentrics, p, rods, q, bars, cloth, so that the cloth will be operated with a compound movement

388. Rotary Harrows; William P. Goolman, Assignor to self, S. B. Morris, and Wm. Hollingsworth, Dublin, Indiana.

Claim—1st. The described application of friction rollers between rotary concentric harrows, to elevate opposite sides of the respective harrows. 2d. The reversible arm, arranged between concentric harrows to change the direction of the rotation of the said harrows. 3d, The reversible bent spindle, adapted in the manner set forth, to correspond with the relative obliquity of two concentric harrows. 4th, The described arrangement of the friction rollers and adjustable washer on the arm, operating in the manner set forth, to vary the relative obliquity of the harrows.

389. Wrenches; Daniel G. Greene, North Bridgewater, Assignor to self and William Nash, South Weymouth, Massachusetts.

Claim—The combination of the movable jaw, inclined shoulders, U, with the pawl and inclined shoulders, V, and enlarged hole, and ratchet teeth, arranged in the manner set forth.

390. Shears; Michael Irion, Utica, Assignor to self and Jacob Heidel, Oneida County, New York.

Claim—The combination of the cutting plates, the circular punch, and the circular die, to receive the punch, and surrounded by a cutting edge, in connexion with a pair of movable jointed arms, arranged in the manner set forth.

391. Lamps; George Marlow and Michael Ralphe, Assignors to A. D. Brown, U. C. Valette, and George Marlow, Cincinnati, Ohio.

Claim—1st, The arrangement of the separate cup-formed back reflector upon the inside of the door, with an open-backed parabolic or conical reflector. 2d. The described arrangement of glazed doors, M and M′, hinged vertically to the front angles of the lantern, and adapted in the manner set forth, to be fixed either in front of the lantern or against one or other of its sides.

392. Piano-forte Actions; Theodore Marschall, Assignor to Lighte & Bradbury, City of New York.

Claim—The spring-supporting post, when used in the described combination with a stud, separate and distinct from the moving parts to detain the hammer at any determined height, while the jack descends sufficiently to re-engage beneath the hammer butt.

393. Churns; E. L. Pratt, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—In combination with the rotary case or body of a churn, a diaphragm or piston, adapted both to move upon and be moved by a screw shaft, or its equivalent, placed horizontally in the said case, as described, the said diaphragm and shaft being constructed as set forth. Also, the series of perforatons through the diaphragm or piston, in combination with the movable perforated adjusting disc or plate, or their equivalent, the same operating together in the case, as described.

394. Cotton Gins; Wm. F. Pratt, Assignor to the E. Carver Company, East Bridgewater, Massachusetts.

Claim—The use of a naked or unshielded auger or cleaver, operating in the end of a ginning roll of a cotton gin at or near the centre thereof, in the manner described.

395. Grain-binding Mechanism; Allen Sherwood, Assignor to E. P. Lenter, A. H. Goss, Wm. Hills, and Ameretta Sherwood, Auburn, New York.

Claim—The combination of the shield and lever, both removable and located at one side of the delivery portion of the platform, so that the shield shall protect the lever from the cut material, and from one side of an open-ended grain receiver (the fence forming the other side thereof), where the grain is deposited previous to being bound. Also, in combination with the raker's stand and binder's seat, the shield and lever, so arranged that the raker, from his stand, may sweep the cut grain into the receiver, and the binder, from his seat, reaches beyond the receiver to catch the lever. Also, in combination with the grain receiver, the inclined ledges, under which the wire is passed, so as not to catch or interfere with the entrance of the grain therein. Also, the slot and flanches in the shield, said flanches serving as a guide for properly bringing down the foot of the lever to insert the wire in the twisting wheel. Also, in combination with the lever, the clamp, located in close proximity to the handle, so that the binder, as he draws up the gavel, may check the paying-out of the wire, and thus bring it tightly around the bundle. Also, the combination of a removable shield and lever, on the platform, with a removable twisting mechanism on the fence or side of the platform, for the purpose of adapting an ordinary hand delivery mowing machine into a self-binder, or vice-versa, without in any manner altering the parts which enables it to be so exchanged, except to attach or detach them, as set forth.

396. Nail Machines; Daniel Dodge, Keeseville, New York.

Claim—The combination of an anvil and fixed die, or other equivalent fixed surfaces, a roller, hammers, and a vibrating guide. Also, the operation of a hammer, in combination with the roller and anvil, by means of an eccentric on the roller shaft, and a universal joint at the connexion of the hammer with the connecting rod of the eccentric.

Disclaimer.

1. Gas Burners; William Blake, Boston, Massachusetts; patented August 9, 1845; disclaimer filed August 5, 1859.

I hereby enter my disclaimer to that part of said burner which was set forth and claimed as the "bell shape or mouth of the lower part of the inner case of said burner."

Extensions.

1. Gas Burners; Wm. Blake, Boston, Massachusetts; patented August 9, 1845; extended August 9, 1859.

Claim—The combination with the space directly beneath the orifices of discharge of the gas, and with the supply or branch tubes, an expansive chamber, so as to operate in the manner set forth. Also, making the lower part of the inner case of the burner with a bell-shaped opening or mouth, in the manner specified.

2. Grinding Mills; Beriah Swift, Washington City, D. C.; patented August 16, 1845; extended Aug. 16, 1859.

Claim—Making the grinding teeth of mills, in concentric rows, projecting from the surface of the plates, so that the teeth of one plate shall run in the spaces between the teeth on the other. and vice-versa, in combination with the grooves or furrows running towards the periphery of the plates, through which the substances acted upon are carried outwards, whether these furrows be arranged radially according to what is technically termed the eight quarter dress, or in any other manner leading from the inner to the outer range of teeth. Also, in combination with the teeth arranged as expressed in the above claim, the breaking the teeth on a cylinder or cone, arranged as described.

Additional Improvements.

1. Ploughs; George Watt, Richmond, Virginia; patented February 9, 1858; additional dated Aug. 2, 1859.

Claim—The combination of the eccentric roller, beam, notches, and cuff, substantially as set forth.

2. Lock; A. A. Richards, Urbana, Ohio; patented Feb. 15, 1859; additional dated August 9, 1859.

Claim—The arrangement of the spring, collar, ring, screw, brake-wheel, and arbor, in the manner described, so as to produce friction between the ring, and wheel, and arbor, and also the arrangement of the brake, indented flanch, and stem, so as to prevent the revolution of the wheel, and arbor, and ring, and the external dial hand.

3. Instruments for Taking Altitudes of the Sun; Frederick Yeiser, Lexington, Kentucky; patented Feb. 8. 1859; additional dated August 9, 1859.

Claim—In combination with the rotary bar, the arrangement of the adjustable bar and dial plate. and rotary cylinder, and adjustable disc, in connexion with the bar, k, and plates, a a, holding the lens, and having on its face a small square to receive the sun's image through the lens, in such relation to each other and to the rotary bar, that it operates as specified.

4. Mole Ploughs; Moses Bales, Big Plain, Ohio; patented Feb. 15, 1859; additional dated Aug. 23, 1859.

Claim—The employment of the cap, in combination with the mole, arranged as set forth.

5. Apparatus for Evaporating Saccharine Juices; L. P. Harris, Mansfield, Ohio; patented Jan. 18, 1859; additional dated August 23, 1859.

Claim—The application of partial, transverse, or oblique partitions to evaporating pans, for the purpose of preventing a continuous transverse channel, arranged in the manner described.

6. Mode of Oiling Journals; Douglas B. Jordan, Cumberland, Rhode Island; patented March 15, 1859; additional dated August 30, 1859.

Claim—1st, The hinging the dish or bucket to the rod, as set forth. 2d. The dish or bucket, in combination with the several parts marked C D E F and I, for the purpose set forth and described.

Re-Issues.

1. Balancing Mill-stones; John Fairclough, Louisville, Kentucky; patented Dec. 21, 1858; re-issued Aug. 2, 1859.

Claim—The employment or use of weights placed within boxes or recesses in the back of the stone. and arranged so that they may be adjusted vertically, and more or less be used in each box or recess to admit of the balancing of the stone or runner, both while in motion and at rest.

2. Nail Machine; Jahaziah S. King, Raynham, Massachusetts; patented October 20, 1857; re-issued August 2, 1859.

Claim—Making cut nails in such a manner that each nail will be seized the instant after it is cut from the nail plate, and be compressively operated upon at the point thereof. in the manner specified, to bring the flat point of said nail plate to an equal-sided sharp point, or to substantially the same character of point that is ordinarily given to wrought nails.

3. Machine for Matting the Ends of Match Blocks; Henry E. Pierce, Charlemont, Massachusetts; patented Jan. 10, 1854; re-issued August 2, 1859.

Claim—Matting the ends of match blocks by pressure of a roller or rollers, for the purpose set forth, and in this claim I wish to be understood that I do not confine myself to the precise arrangement of the parts described, but shall vary them at pleasure, while I attain the same ends by means substantially the same.

4. Clothes Dryer; Stephen H. Tift, Morrisville, Vermont; patented July 20, 1858; re-issued Aug. 2, 1859.

Claim—The combination of the slotted. perforated hub, and slotted, bored cap-hub, with the arms and braces connected with the hubs by wires, as described, and the arrangement of the same with the shaft, collar, and ratchet catch.

5. Ploughs; George Watt, Richmond, Virginia; patented Feb. 9, 1858; re-issued August 2, 1859.

Claim—Constructing mould-board and land-side of cylindrical surfaces of equal diameters, intersecting along the cutting edge of the plough, in combination with the standard curving landward from the top of the mould-board to a position nearly over the base of the land-side.

6. BREECH-LOADING ORDNANCE; G. W. Bishup, City of New York; patented March 8, 1859; re-issued August 16, 1859.

Claim—Combining the movable breech-pin with the bore of the cannon, by means of movable locking or abutting pieces or segments, and which, after the breech-pin is inserted, are shifted and made to cross the joint of the breech-pin and bore, to hold the breech-pin against the force of the discharge.

7. ASH-SIFTERS; Allan Cummings, City of New York; patented March 8, 1859; re-issued Aug. 16, 1859.

Claim—The employment of a conical sieve, or sieve of an equivalent form, in combination with the two receptacles, one for the sifting and the other for the substances sifted. Also, the conical deflector for deflecting the substances to be sifted, and concentrating them in combination with the spreader, whether the spreader be itself the sieve or employed with the sieve below. Also, in combination with the sieve, the under conical surface of the deflector for preventing the escape of dust from the apparatus. Also, in combination, the deflector, the spreader, the conical sieve, and the receptacles for the siftings and the substances sifted.

8. SASH-FASTENER; Ralph J. Falconer, Washington City, D. C.; patented August 31, 1858; re-issued August 16, 1859.

Claim—Extending the cap portion of the catch over and along the front edge of the catch-plate, to form a catch-opening flush with the edge of plate, so that the window cannot be unfastened without having the point of the hook withdrawn entirely clear from the meeting rail of the upper sash, and out of the way of the bars above when the lower sash is raised. Also, in combination with the catch, hook, and plate, I claim the check, or equivalent thereof.

9. VALVE COCKS; J. R. and H. S. Robinson, Clinton, Massachusetts; patented Aug. 31, 1858; re-issued August 16, 1859.

Claim—1st, The method of constructing valves, valve cocks, and gates, so that, when the port or ports therein are uncovered, there shall be a straight passage or passages from the induction port or ports in the valve chamber to the eduction port or ports in the same, whether the valves in such valves, valve cocks, and gates, are made in one or more than one piece. 2d, Making the valves in valves, valve cocks, and gates, in separate or detached pieces.

10. MACHINES FOR MAKING PAPER BAGS; Francis Wolle, Philadelphia, Pennsylvania; patented July 6, 1858; re-issued August 16, 1859.

Claim—1st, The combination of the creaser and lappers, arranged and operating in the manner described. 2d, The folding of a lap in the manufacture of a bag of paper, or other material, by means of a creaser blade and two rolling surfaces, operating in combination with each other. 3d, The revolving lapper shaft, in combination with the creaser, the feeding roller, and aprons, the creaser being brought into operation on the lap during the intermission in the motion of the feed rollers.

11. TREATING CAOUTCHOUC AND OTHER VULCANIZABLE GUMS; Conrad Poppenhusen, City of New York, Assignee of L. Otto P. Meyer, Newtown, Connecticut; patented April 4, 1854; re-issued August 16, 1859.

Claim—The mode of operation, as described, which said mode of operation consists in the employment of a pliable or flexible envelope, or the equivalent thereof, applied by pressure to the hard compound of vulcanizable gum, while in the green or plastic state, so as to insure the contact of such covering with the surface of the compound, and while thus covered or protected, subjecting it to the vulcanizing heat, and when vulcanized, stripping off such covering.

12. REFINING IRON IN THE HEAT OF A BLAST FURNACE; Christian Shank, Canton, Ohio; patented May 17, 1859; re-issued August 16, 1859.

Claim—The employment, immediately before the tapping of the furnace, of an auxiliary tuyere pipe or pipes within the hearth of the common blast furnace, when charged with molten iron, at such an inclination as to cause the blast of air to commingle with the particles of iron, and give to the whole mass in the hearth a spiral or rotary motion.

13. BILLIARD TABLE CUSHIONS; H. W. Collender, City of New York; patented December 8, 1857; re-issued August 23, 1859.

Claim—Composing cushions for billiard tables with a body or back of what is known as the soft compound of vulcanizable india rubber or allied gum, in combination with a facing of india rubber or allied gum, rendered less compressible by fibrous matter, or the equivalent thereof.

14. RAILROAD STATION INDICATORS; C. A. McEvoy, Richmond, Virginia; patented Nov. 20, 1855; re-issued August 23, 1859.

Claim—Presenting a movable sign or symbol to passengers of a railroad car, so that both sides of said sign shall be visible, and utilized as annunciators by passing each sign in turn through an opening of the case, by the revolving of the drum to which the said signs are attached.

15. FAUCETS; James Powell, Cincinnati, Ohio; patented March 22, 1859; re-issued July 5, 1859; re-re-issued August 23, 1859.

Claim—1st, The valve stem, formed with projecting flanches, when confined to a rectilinear path and operated by a cam or eccentric, which engages with it at two opposite points, in the manner set forth. 2d, The arrangement and combination of the slotted head, pivot, socket, and cam, operating in the manner set forth, to prevent lateral motion of the valve stem.

16. LAMPS; Michael A. Dietz, Brooklyn, New York; patented May 3, 1859; re-issued August 30, 1859.

Claim—Combining the deflector with the chimney band by mechanical devices, so as to retain the former in its proper relative position without the use of solder.

17. DEVICE FOR CONVERTING RECIPROCATING INTO INTERMITTENT ROTARY MOTION; Henry Ehrenfeld, City of New York; patented June 21, 1859; re-issued August 30, 1859.

Claim—1st, Arranging the lever and dog, in combination with the grooved wheel, or its equivalent, in such a manner that said lever and dog act on the wheel, without a connexion to the centre or hub of the wheel. 2d, In combination with the lever, dog, and wheel, the arrangement of the groove, or its equivalent, in the hub of the wheel. 3d, Arranging the lever with the dog permanently attached to it in such a manner that the direction of the said lever, when it is in its place, makes an angle of 90°, or nearly so, with a line drawn from the centre of the wheel through the dog.

18. HARROWS; Sidney S. Hogle, Cleveland, Ohio; patented March 7, 1857; re-issued August 30, 1859.

Claim—Causing the points of the teeth of a rotating harrow to descend deeper into the ground on one side of their axes of rotation than they do on the opposite side of the same, for the purpose of enabling the

dragging force which may be exerted upon said harrow, to impart a positive rotary motion thereto without the aid of gearing wheels.

19. Eraser and Pencil-sharpener; Archibald G. Shaver, Hartford, Connecticut; patented March 8, 1859; re-issued August 30, 1859.

Claim—1st, The curved blade eraser, as specified, forming on one side a convex surface. 2d, In combination therewith, the pencil-sharpener and pointer, as described.

Designs.

1. Parlor Stove; Robert Ham, Assignor to Smith, Shelden & Co., Troy, New York; dated August 9, 1859.

2 and 3. Carpet Patterns (two cases); E. J. Ney, Assignor to the Lowell Manufacturing Co., Lowell, Mass.; dated August 9, 1859.

4. Parlor Coal Stove; Isaac de Zouche, St. Louis, Missouri; dated August 9, 1859.

5. Table Fork; N. E. Russell, City of New York; dated August 9, 1859.

6. Stoves; Garrettson Smith and Henry Brown, Assignors to Cox, Whitman & Cox, Philadelphia, Penna.; dated August 16, 1859.

7 and 8. Floor Oilcloth (two cases); James Bogle, West Newton, Massachusetts, Assignor to self and Daniel Bogle, Dover, New Hampshire; dated August 23, 1859.

9. Spoon or Fork Handles; Henry Hebbard, City of New York; dated August 23, 1859.

10. Scales; Francis M. Strong and Thomas Ross, Brandon, Vermont; dated August 23, 1859.

11. Floor Oilcloths; Jean Baptiste Virolet, Assignor to John W. Hoyt, City of New York; dated August 30, 1859.

12 to 14. Carpet Pattern (three cases); Henry G. Thompson, City of New York, Assignor to the Hartford Manufacturing Co.; dated August 30, 1859.

15. Three-ply Carpet Pattern; Henry G. Thompson, City of New York, Assignor to the Hartford Manufacturing Co.; dated August 30, 1859.

SEPTEMBER 6.

1. Lamps; H. W. Adams, Brooklyn, New York.

Claim—Constructing the upper end of the wick tube with the elevated ends, so as to enclose the ends of the wick and prevent said ends from burning too high, when the central part is sufficiently elevated above the central part of the wick tube to be allowed to burn.

2. Apparatus for Making Decoctions; William Adamson, Philadelphia, Pennsylvania; ante-dated April 6, 1859.

Claim—The conical roller arranged within the caldron, when the same is used for the purpose of thoroughly intermixing the ingredients to be extracted during the process of boiling.

3. Cutting Apparatus of Harvesters; T. D. Aylesworth, Ilion, New York.

Claim—The cutters and guards, when constructed and operating together without any motion except that of being advanced or drawn over a field.

4. Tongueing and Grooving Machine; H. H. Baker, New Market, New Jersey.

Claim—The employment of flanched feed rollers, having a lateral play, and acted upon by suitable springs, in combination with the fixed intermediate rings or flanches, or their equivalents, in the manner specified.

5. Railroad Excavators; E. O. Baxter, Foreston, Illinois.

Claim—The arrangement and combination of the adjustable timbers or arms, plough and excavator, when employed in the manner shown, for the purpose of loosening and removing the earth, and keeping the ditch free from the wash of the slopes on railroads.

6. Tanning; John Brainerd and W. H. Burridge, Cleveland Ohio.

Claim—The use of the described compound for tanning, consisting of a solution of the named mineral salts, in mixture with a solution of tannin, either with or without the addition of aloes.

7. Making Gas from Wood; L. R. Breisach, City of New York.

Claim—The process of manufacturing illuminating gas from wood, by distilling the same in two retorts of varying temperatures, one of which retorts is charged with charcoal, varying in amount according to the conditions indicated, the whole process being conducted as set forth.

8. Railroad Wheels; Archibald Cameron, Charleston, South Carolina, and David Matthew, Philadelphia, Pennsylvania.

Claim—The peculiar construction of car wheels, having elastic curved arms, with chilled cast tread and cast hub, forming one combined wheel.

9. Machine for Making Watch Rims, &c.; C. W. Clewley, Providence, Rhode Island.

Claim—The combination of the male and female plungers, as described.

10. Machine for Printing the Addresses on Newspapers, &c.; R. W. and Daniel Davis, Yellow Springs, Ohio.

Claim—1st, The arrangement of wooden blocks of suitable size for a single address, with indented letters in their faces, and attached by means of small tacks, or equivalent, to a flexible band or belt in close compact columns, and operated as described. 2d, The use of the triangular stationary bed-piece, over which the belt slides, by means of belt pulley, and regulated and adjusted by means of lever.

11. Treating Metallic Ores with Spongy Iron; Jean Justin Albert de Bronac and Augustin Joseph Martial Deherrypon, Paris, France.

Claim—The treatment of metallic sulphurets, or other ores or metallic bodies, with a spongy iron, for purposes set forth, by the combination of the several processes specified in the order stated, viz:—1st, Pulverizing the ore and the spongy iron separately. 2d, Mixing the two powders in definite proportions. 3d, Compressing the mixed powders into the form of cakes or small bricks. 4th, Treating the thus prepared ores in suitable furnaces, as described.

12. Machine for Sawing Staves; R. Densmore, South Haven, Michigan.

Claim—1st, Surrounding the stationary drum with a series of saws all hung in one gate, and having the same movement, in combination with the rotating table, in the manner specified. 2d, In combination with the rotary table and drum, the sliding carriages, arranged radially around said drum, and operated automatically to feed the bolts up against the drum. 3d, The rolling spring guides, in combination with the drum for discharging the staves from the machine after they have been sawed.

13. Bagasse Furnaces; Charles A. Desobry, Plaquemine, Louisiana.

Claim—The combination of the upright air chamber, having a vertical partition wall, and the system of ducts, and the damper or shutter, applied in connexion with the fire chamber and the flue, or its equivalent.

14. Portable Evaporating Apparatus; Hugh T. Douglas, Zanesville, and John Cooper, Mount Vernon, Ohio.

Claim—The combination of the diving flue, the valves, and the damper, arranged in relation to the evaporating pan, and operating in the manner set forth.

15. Roofing Cement; M. D. Dubois, Newburgh, New York.

Claim—A composition formed of the ingredients or substances compounded, in the proportions and in the manner specified.

16. Boots; Lewis Duvall, Big Spring, Kentucky.

Claim—The described method of cutting the piece of leather, or other suitable material, and uniting the same with the gore, so that when it is folded in the lines b b′ and f f′, and if the gore is brought in the proper position, said piece, together with the gore, assumes the required shape of the upper of a boot.

17. Machine for Cutting and Finishing Shoe-heels; Wm. T. Edson, Philadelphia, Pennsylvania.

Claim—The combination of the movable post, the former (on the upper of the shoe), the guide, and the cutter wheel, or an emery or burnishing wheel, with the hand lever, bow guide, springs, and radius bar, for cutting or shaping, smoothing, and burnishing the heels of shoes, either before or after they are fastened to the shoe.

18. Automatic Rake for Reaping Machines; Benjamin G. Fitzhugh and McClintock Young, Jr., Frederick, Maryland.

Claim—The locating of an automatic sweep rake at the rear, left-hand, or outside corner of the platform, when said rake has a rising and falling motion that will admit of its passing over the outside division board or fence, and then drop into or on to the extreme outer end of the platform, and sweep it off the cut grain.

19. Foam-collectors for Steam Boilers; Thomas G. Gardner, Mount Pulaski, Illinois.

Claim—Fitting a boiler with one or more plates, so applied as to present inclined surfaces above the surface of the water, with one or more outlets for steam and foam, at the highest parts of said plate or plates, and as to provide a receptacle for foam above the said plate or plates.

20. Apparatus for Mashing; Edward Hæckel, Assignor to Hæckel & Co., Cincinnati, Ohio.

Claim—The described combination and arrangement of the central shaft and satellite shafts, the whole being armed with beaters, and rotated simultaneously.

21. Flood Gates; E. H. Hancock, Augusta, Georgia.

Claim—The combination of the flood or dam gate, tilting trough, and the draining structure, or its equivalent, as set forth.

22. Sewing Machines; Jason W. Hardie, City of New York.

Claim—1st, The method of making the "knot-stitch," by taking the needle-thread at the back of the needle, or at the side opposite to the position of the bobbin, and first doubling it upon itself around the needle and then looping it over the bobbin thread. 2d, The employment of two hooks, acting in opposite directions, when they take the thread at the back of the needle, or at the side opposite to the position of the bobbin, for the purpose of forming either the knot-stitch or the ordinary shuttle-stitch, by simply reversing the motion of the driving shaft. 3d, Making the feed eccentric self-adjusting by means of the loose sleeve, slot, and pin or stop, so that the feeding shall take place during the descent of the needle, whichever way the driving shaft may be turned.

23. Carpet-sweeper; Hiram H. Herrick, East Boston, Massachusetts.

Claim—1st, Providing the end of the box with a groove, as from x to x, when the same is used in connexion with the flaring brush on the end of the shaft. 2d, Dividing the box into two parts, and providing each with a partition dividing the bottom of the box in two parts, through which the brushes protrude, and providing these parts of said bottom with flanches which hold the dirt.

24. Amalgamator; Kelsey Hazen, Brooklyn, New York.

Claim—Compelling the water having the particles of gold in suspension to flow within a certain small distance of the heated mercury, under conditions as set forth. Also, in connexion with the above, the employment of a series of vibrating agitators and scrapers, acting in the space under E, and of an adjustable gate for regulating the facility of egress of the least suspended particles.

25. Mole-ploughs; Iris Hobson, Stout's Grove, Illinois.

Claim—The combination of a ditching plough beam, having a horizontal joint forward of the mole and coulter, with a rod arranged over the top of said joint, and with a horizontal, adjusting, and stop-plate.

26. Door-bolt; Lewis G. Hoffman, Waterford, New York.

Claim—The combination of a common door-bolt with a barrel containing a wheel, with an arm acting on a slot in the bolt, so that when operated by a key the door may be fastened or unfastened on the outside; the whole being so arranged as not to interfere with the ordinary mode of using the bolt on the inside.

27. Marine Propellers; Lorenzo Holtslander, Oberlin, Ohio.

Claim—The device described for changing valve seats as applied to water propellers, to reverse the motion of vessels or boats. Also, the combination of the small forward pipes with the reservoir, as described.

28. Apparatus for Printing the Address on Newspapers, &c.; George Hutchison, Alleghany, Penna.

Claim—1st, The inclined hopper with the slides or guides, in combination with the ways and conveyors on the belt, as described. 2d, The use of a metallic belt, furnished with the conveyors, as described. 3d, The arrangement of the pulleys, the belt, press-roller, and inking roller, as described. 4th, The use of the lug on the end of the type frame, when used in connexion with the notch in the conveyor, as described.

29. Parlor Grates; Damase Lamoreux, City of New York.

Claim—1st, So constructing the grate that the fuel box and the ash-pit are distinct from, and independent of, the bars, and capable of being removed, while the bars remain undisturbed, thereby enabling me to effect the removal of the ashes and cinders with much less trouble than by the ordinary mode, and thereby keep the apartment free from the dust and dirt which are inseparable from the common method of removal. 2d, The combination of the crank, the rod, and the movable bottom of the fuel box, arranged as described, by which any easy and convenient means of giving a reciprocating, horizontal, circular motion of the grate bottom is secured without the necessity of cutting an opening in front for the passage of an arm, by which to vibrate the grate. 3d, The arrangement, in a parlor grate, of the bottom grate upon which the fuel is supported, in the manner described, by which it is made capable of being vibrated through the back of the fuel box, upon a fixed axis placed entirely back of the space devoted to fuel, the wings of said bottom grate being so extended as to cover or compensate for the necessary vibration which is made into open space back of the fire box.

30. Method of Centering in Watchmaker's Lathes; Pierson Leff l and J. H. Mulholland, Springfield, O.

Claim—1st, A vibrating mandrel, arranged within a socket or hollow spindle, in such manner that its inserted end may fit closely within said socket, and its outer end allowed to vibrate. 2d, In combination with the vibrating mandrel, we claim the rocking collar, spring, key, and nut, arranged to operate as described.

31. Submerged Pump; Hosea Lindsey, Ashville, North Carolina.

Claim—The arrangement of the short reciprocating piston rod, open pistons, sliding ring valves, cylinder, having a conducting pipe, with the chain and brake, in the manner set forth.

32. Steam Pans for Clarifying Sugar; George M. Longacre, New Orleans, Louisiana.

Claim—In combination with the pans, the relief valve, and the check valve, arranged as set forth.

33. Lamps; Justus R. Loomis, Winsted, Connecticut.

Claim—The arrangement of the cylindrical corrugated skirting, perforated tubes, adjustable radiating wires, in the manner described.

34. Stoves; Edward M. Manigle, Philadelphia, Pennsylvania.

Claim—The arrangement of the series of distinct or uncommunicating hollow open air chambers, or their equivalents, in combination with the cross-piece of the top plate of a cooking stove, in the manner described, and this I claim whether the said cross-piece be either movable or stationary in the said top plate.

35. Machine for Wiring the Joints of Clothes-pins; Alvin C. Mason, Springfield, Vermont.

Claim—1st, The intermittently rotating pliers, in connexion with a clamping device formed of the jaws, recess, and lever, or their equivalents, and shears, arranged to operate as set forth. 2d, In combination with the pliers and shears, and clamping device, the sliding forks, arranged for joint operation. 3d, The particular manner of opening and closing the pliers, and operating the arbors, to wit: by means of the sliding cones in connexion with the springs and permanent bosses on the arbors, whereby the jaws of the pliers are opened and closed, and the arbors shifted by a very simple mechanism.

36. Brakes for Railroad Cars; Thomas J. Mead, Port Byron, New York.

Claim—The combined use of the U-shaped yoke, the brake bar, and the short brake blocks, for the purpose of adapting the brake to a simple lever that acts directly upon it.

37. Machine for Bending Wagon-tire; Wm. and Isaac H. Mosher, Greene, New York.

Claim—The clutch or clasp to hold the end of the bar, in combination with the former being made three-fourths of the circle, and the arrangement of the lever, for operating as specified.

38. Trunks; Jacob Parker, St. Louis, Missouri.

Claim—1st, Forming the lid of the trunk in the shape of a semi-cylinder, as specified. 2d, The impervious box or sponge-carrier, arranged in the tray as described. 3d, The peculiar formation of the division boards, in such manner that they will come down on to the rim of a gentleman's hat, placed in the middle hat box.

39. Bits for Cutting Washers; Henry Pennie, Buffalo, New York.

Claim—1st, The arrangement of the cutters upon the ends of the sliding bars, and at right angles thereto; the said sliding bars passing through a mortise in the shank and lying parallel with each other, and one above the other, so that the cutters will work upon the same side of the centre-point. 2d, The recess made in the lower end of the shank, so as to allow the inner cutter to slide close up to the point, and thereby adapt the instrument to cutting very small washers.

40. Faucet; James Powell, Cincinnati, Ohio.

Claim—The elastic annular valve seat and sliding collar, in the described combination with an adjustable plug valve of hard metal.

41. Construction of Sheet-metal Coffins; Isaac C. Shuler, Amsterdam, New York.

Claim—1st, The construction of a sheet-metal coffin in two sections, stiffened with frames or straps, and, in dividing the coffin into two sections, I do not confine myself to any particular locality on the sides for making the joints, but claim forming the joint on the side of the wall at any convenient point between the flanch and the rim, and concealing the same with an adjustable moulding. 2d, The frames for stiffening the coffin, and also the scrolled rim or joint.

42. Stoves; David G. Stafford, Syracuse, New York.

Claim—The combination of a self-regulating valve applied to the smoke-pipe of coal stoves, and operating as set forth, with an air-flue surrounding the fire-box, as described.

43. Grates; Joseph Tiben, St. Louis, Missouri.

Claim—Arranging the adjustable furnace back in the furnace place, and constructing the same as set forth.

44. Joiner's Clamp; William S. Todd, Mechanicsville, Iowa.

Claim—The combination of the adjustable lever with the frame and sliding block, arranged in the manner set forth.

45. Construction of Cane Juice Boxes; Louis Tregre, Parish of St. John the Baptist, Louisiana.

Claim—The method of separating the pure from the impure parts of the juice, when the latter has settled to the bottom of the box, so that the pure parts can be drawn off without disturbing the impure, by dividing

the one from the other by means of a movable partition valve, or its equivalent, arranged within the box, as described.

46. Hot Air Register; E. A. Tuttle, Brooklyn, New York.

Claim—The arrangement and combination with the leaves of the roller, having its axis movable and traveling on a shelf, with or without springs, as described.

47. Mode of Operating the Fingers of Printing Presses; Stephen D. Tucker, Assignor to R. M., R., and P. S. Hoe, City of New York.

Claim—Operating the finger-shaft by means of a grooved disc attached thereto, and the roller attached to a plate or proper support, so as to be respectively within and without the path of rotation of the finger-shaft.

48. Printing Presses; Lemuel T. Wells, Cincinnati, Ohio.

Claim—In the described combination with stationary buttments on the ways, I claim the attachment to the bed of a closed cylinder, its piston having a stroke relatively less than that of the bed, and acting to simultaneously condense and rarify the air at alternately opposite ends of the cylinder, as set forth.

49. Opening Valves to Extinguish Fire; S. H. Wilder, Grinnell, Iowa.

Claim—The arrangement of a reservoir, or other means of producing pressure, combined with a system of tubes, cross tubes, and valve shafts, with valves and stop-cocks, arranged as described, when used as a means of operating upon a cylinder and piston, or a water wheel, for the purpose of starting and afterwards stopping the wheel or engine without the intervention of any person than the one who discovers the fire. Also, the use of gear wheels, rack bar, and blank wheel, or their equivalents, arranged to move the gate of a water wheel out and in alternately by a repetition of the same motion.

50. Apparatus for Watering and Sweeping Railways; Wm. C. Allison, Assignor to self and John Murphy, Philadelphia, Pennsylvania.

Claim—1st, The horizontal perforated pipe and the swing pipes, in combination with a truck having wheels adapted to the rails of a passenger railway, the said truck carrying a tank, and the said swing pipes being arranged and operated by the devices described, or their equivalents. 2d, The combination of the adjustable revolving brushes with the truck, arranged in respect to the rails, as specified. 3d, In combination with the brushes, any convenient number of projections, revolving simultaneously with the said brushes, and so arranged in respect to the rails as to clean the grooves or corners of the treads from all obstructions.

51. Feed-water Apparatus for Steam Boilers; Wm. Barnes, Assignor to Philo B. Stewart, Troy, N. York.

Claim—1st, In combination with a steam boiler and a close chamber, placed higher than, or at the same height as, the steam boiler, and having communication therewith by a steam passage and a water passage, each provided with a stop-cock or valve, a close receiver located lower than the boiler, and having a steam passage from the boiler and a water passage into the chamber for use in raising water from a place lower than, and introducing it into, the boiler while the boiler is charged with steam. 2d, In combination with the matter above claimed, making the receiver in two parts, with the steam pipe from the boiler and the cold water supply pipe, both entering one part, and the hot water supply pipe entering, and a water pipe to the chamber, leaving the other part, and with the two parts of the receiver connected together by a passage, as set forth.

52. Mode of Applying Power to Machinery; Delectus Durfey, Fort Seneca, Assignor to self, L. A. Lyon, and H. P. Tyler, Clarksfield, Ohio.

Claim—The combination of the treadle levers, arms, and springs, with the grooved wheel and spring braces, operating as described.

53. Compound Illuminating Fluid; N. A. Dyer, Medford, and J. F. Augustus, Boston, Mass., Assignors to Joseph C. Tucker, Brookline, New Hampshire.

Claim—The combination of ingredients, for the purpose set forth, and essentially in the proportions described.

54. Printing Presses for Addressing Newspapers, &c.; George Henderson, Assignor to self and George Hutchison, Alleghany, Pennsylvania.

Claim—1st, The combination and arrangement of the guide table and pulley, the press-wheel, the conveying pulley, and inking rollers, with type frame and the open hopper, arranged in the manner specified. 2d, The use of the open hopper, constructed as described. 3d, The use of the pins, or their equivalent, on the type frame, for the purpose of carrying forward the papers.

55. Watches; Charles E. Jacot, Assignor to Saltzman, Jacot & Co., City of New York.

Claim—1st, Constructing the bridge or plate with the curve and index, for the purposes specified. 2d, Constructing the bridge plate separately from, but screwed to, the three-quarter plate, for giving access to the centre, second, and third wheels, without removing said three-quarter plate. 3d, Attaching the three-quarter plate to the dial plate, by riveting the columns to the plate and inserting the screws at the dial plate, for the purposes set forth. 4th, Constructing the click spring, as specified, for preventing the ratchet teeth being broken.

56. Stoves; John Martino, Assignor to D. Stuart and Richard Peterson, Philadelphia, Pennsylvania.

Claim—The division plate, L, with its damper, the plate, k, with its openings, and the casing with its wings, arranged in respect to each other and to the outer casing and fire-pot, as set forth.

57. Forcing Pump; Robert Poole, Assignor to self and German H. Hunt, Baltimore, Maryland.

Claim—Enlarging the areas of the inlet and exit openings, where they connect with the pump cylinders, by means of the swells, in the manner set forth.

58. Pistons of Pumps; Robert Poole, Assignor to self and German H. Hunt, Baltimore, Maryland.

Claim—A valve made of flexible material hung loosely upon the piston rod, and having for its bearings the round edged wings of the nut by which it is fastened to the piston, in the manner described. Also, in combination with a flexible valve and winged screw-nut, a piston constructed of ribs, which presents sharp edges to the water while they are flat at the end, which constitutes the seat of the flexible valve, in the manner described.

59. Automatic Fan; John B. Powell, Assignor to self and G. B. Frick, Philadelphia, Pennsylvania.

Claim—The spindle, with any convenient number of cog-wheels of different sizes, in combination with a similar number of cog-wheels, also of different sizes, on the crank spindle, when the said spindle and its wheels are rendered adjustable, and are applied to, and combined with, the work of the automatic fan.

60. TIN-FOLDING MACHINES; Charles H. Raymond, Assignor to the Pecksmith Manufacturing Co., Southington, Connecticut.

Claim—The arrangement of the clamp with bed-piece and folder. when combined with revolving gauge, so that the width of the crimp or fold may be first gauged, and then that portion of the tin contiguous to the part intended to be folded be first firmly clamped and held fast, and then the fold or crimp formed thereon, in the manner described, all by one simple movement of folder, and parts in connexion, and without marring the tin.

61. HARVESTING MACHINES; G. W. Richardson and Robert Glover, Assignors to selves, J. B. Williams, and W. A. Horrell, Grayville, Illinois.

Claim—The cams, cast in sections of one or more, and secured to the driving wheel by means of a bolt or screw and flanch, in the manner described.

62. MACHINES FOR BREAKING STONES FOR TURNPIKE ROADS, &c.; Ives Scoville, Assignor to self and W. H. Scoville, Chicago, Illinois.

Claim—The arrangement of the funnel-shaped hopper, constructed as described, with the two vertical cylinders, as described, for the purpose of breaking stones for ballasting railroads and Macadamizing streets, turnpikes, &c.

63. GAS BURNERS; Daniel H. Solliday, Philadelphia, Pennsylvania, Assignor to Edward H. Ashcroft, Boston, Massachusetts.

Claim—The application of the conical or chambered burner to the main burner, in manner set forth.

64. MACHINE FOR MAKING PAPER-BOXES; Silas B. Terry, Assignor to Silas B. Terry, Jr., Terrysville, Conn.

Claim—1st, The pressure roller, in connexion with the rotating clamp formed of the head and disc, arranged as set forth. 2d, In combination with the pressure roller, head, and disc, the ring or band provided with the pins or stripes, the socket provided with the screws or pins, and the guide plate, arranged as described. 3d, The arrangement of the pressure lever and sliding mandrels, for the purpose specified. 4th. The employment or use of the folding device formed of the plate provided with the ledge, and the pivoted bar, when said folding device is used in connexion with the pressure roller, rotating head, and disc.

65. SKELETON SKIRTS: Joseph Wesley, Assignor to Joseph B. Wesley, Providence, Rhode Island.

Claim—A skirt having its hoops supported by tapes or straps, which are rendered adhesive by the application of caoutchouc or gutta percha, in the manner described.

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66. SADDLE-TREES; Henry Adams, City of New York.

Claim—A tree for side or ladies' saddles, constructed by connecting the bars by a bridge at the point specified, and with an open space between the front ends of the bars, at their junction with the horns.

67. RAILS FOR RAILROADS; George S. Avery, Cross River, New York.

Claim—An improvement in railroad iron bars or rails by an offset or bend. made in one end of the rails, and the lapping on of the other end of the rails, and inserting a key between them at the lap, and riveting or bolting them together.

68. DITCHING PLOUGHS; O. S. Bartlett, Romulus, New York.

Claim—The combination of the arms, brace, rods, and blocks, as set forth. Also, the mode of attaching and adjusting the shares by means of the packing blocks, in combination with the bolts and arms, in the manner specified.

69. STRAW-CUTTERS; A. F. Blunk, Indianapolis, Indiana.

Claim—A straw-cutter, constructed with angular knives, arms, wheel, feed rollers, slides, springs, band, pulleys, and endless belt, arranged to operate as described.

70. WINDOW-SASH FASTENERS; E. K. Breckenridge, West Meriden, Connecticut.

Claim—The employment or use of two cams, placed on a common arbor, with a spring applied to them and a lever fitted within a frame, and arranged to operate as set forth.

71. SEED PLANTERS; Z. B. Brown and M. C. Godard, Granby, Connecticut.

Claim—The arrangement and combination of the carrier and stamping wheels, cams and marker device, upon the wheel, the reciprocal levers, seed slides or valves, hoppers, drill formers, and covering shares, in the manner described.

72. SEWING MACHINES; J. S. Buell, Buffalo, New York.

Claim—1st, In combination with the stationary corrugated surface, the corrugated foot-piece, constructed as set forth. 2d, In combination with the needle or its thread, the conical spool and guide, for causing the slack in the thread to form the loop, and holding said loop from turning until seized by the looper.

73. SEED DRILLS; Stephen Burrows, Lima, Wisconsin.

Claim—The employment of a grooved ring fitted on the axle or shaft of a seed drill, in combination with the peculiarly constructed tube, leading from the hopper into the groove of the ring.

74. CHURN; William Campbell, Waterloo, Pennsylvania.

Claim—The perforated and hinged floats, as an improvement in the construction of dasher-heads for churns.

75. EXTRACTS OF FRUIT; Rosanna Carpenter, Medford, Massachusetts.

Claim—The described extract of fruit, prepared in the manner specified.

76. HAND-MILLS FOR GRINDING APPLES, &c.; R. P. Clark, Johnstown, New York.

Claim—The described improved hand-mill for household use, in reducing apples, potatoes, and other fruits and roots to pomice—the teeth of the combined cylinder and adjustable yielding concave being formed and arranged in the particular manner set forth.

77. FASTENING FOR SHIRT STUDS; Barnes Clayton, Philadelphia, Pennsylvania.

Claim—The hollow sliding case and spring, in combination with the tie or post and the bar, arranged to operate together in the manner set forth.

78. WIRE FENCES; P. S. Clinger, Conestoga Centre, Pennsylvania.
Claim—The combination of the pin with the ratchet in connexion with the mortised posts and the hooked wires, arranged as described.

79. COTTON SEED PLANTERS; T. T. and H. W. S. Collier, Lavernia Texas.
Claim—The arrangement and combination of the distributor and the stirrer, constructed as described, to operate in combination with the packing wheel.

80. SIGHTS FOR FIRE ARMS; Henry W. Colvin, Pendleton County, Kentucky.
Claim—The semi-circular form of the fore-sight with its range-piece or bead and shades, and triangular form of the hind-sight with its needle or range and shades, substantially as described, and for the purpose set forth.

81. ROTARY HARROWS; George Cook, Paris, Illinois.
Claim—The arrangement of the teeth, placed eccentrically on triangular frames which rotate on oblique pivots, as specified.

82. COFFEE-POTS; Solomon Crowell, Jr., Palmyra, New York.
Claim—The combination of the perforated diffusing chamber, having a tight conical bottom, with the concentric perforated digester, whereby the coffee is exposed in a thin layer of nearly uniform thickness, to the water percolating nearly uniformly through all parts.

83. BRAKES FOR RAILROAD CARS; Henry Davis, Baltimore, Maryland.
Claim—Increasing the frictional action of the car brakes upon the peripheries of car wheels, by the introduction of sand, or its equivalent, between the frictional surfaces, at the time that the brakes are brought in contact with the car wheels.

84. PIANO-FORTE ACTIONS; David Decker, City of New York.
Claim—1st, Attaching the relieving jacks and regulating screw directly to the key, or to some part carried by the key, so that the repeating lever shall govern the action of the relieving jack, by or through the said regulating screw, whether constructed in this precise manner or in an equivalent. 2d, The groove, in combination with the tongue, pin, or equivalent, for the purpose of keeping the lifting-jack in its proper position in relation to the repeating lever, and for preventing any binding or sticking of said repeating lever and lifting-jack. 3d, So arranging the adjustable piece and repeating lever, both or either of them, so that their regulating screws, both or either of them, shall be at or near the end next toward the front of the key, in front of the hammer rail, for the purpose of being thus conveniently placed for regulating.

85. PRISON LOCK; Sylvanus A. Denio, Boston, Massachusetts.
Claim—The lock or part, b, with its parts, c e i and k, arranged with each other, as described, to move, hold, and lock the bolt, k, in door, l, when combined, positioned, and secured with lock, h, which in turn locks the shaft, all by turning a single knob—all the parts being constructed and operated in the peculiar manner described.

86. HEELS FOR BOOTS AND SHOES; Simeon Dodge, Jr., and Benjamin Potter, Jr., Marblehead, Massachusetts.
Claim—A heel having a concave seat and a flat tread, with its rises united by cement.

87. SWITCH-STAND FOR RAILROADS; Thomas Dougherty, Macon, Georgia.
Claim—The combination of eccentric with the pin, C, through lever to bar, for the purpose of locking and unlocking the main pin, A, to and from notches, M M M.

88. FAUCET; Eugene Duchamp, St. Martinsville, Louisiana.
Claim—The arrangement and combination of the oblique slot, handle, stem, and tube, so that on turning the handle, the stem will rise and fall with a spiral or screw movement, thus insuring ease of operation and tightness of packing.

89. FILTER; Eugene Duchamp, St. Martinsville, Louisiana.
Claim—The employment of fine spun glass, arranged in the manner set forth, in combination with the reservoir, floating valve chamber, and pure water chamber.

90. APPARATUS FOR HEATING WATER; Eugene Duchamp, St. Martinsville, Louisiana.
Claim—The combination and arrangement with the false bottom and tank, of the perforated casing, fire chamber, draft-pipe, and smoke-pipe, as described.
[This invention consists in placing within a cylinder or outer casing, perforated at the top and bottom, a smaller cylinder, which latter serves as a fire chamber; these are placed in the centre of a tub having a false bottom, so that when the water, clothes, and soap are put around the boiler in the tub, and a fire made in the inner chamber, a constant rotary current of the water in the tub will be obtained, and the dirt carried to the bottom of the tub.]

91. MOP-HEAD; John Fasig, West Salem, Ohio.
Claim—The construction of a mop-head, consisting of the piece with the slot and hole, in combination with the rod and notches, screw and nut, arranged as set forth.

92. HARNESS; Jacob Fassnacht, New Milltown, Pennsylvania.
Claim—The device of combining the hip-strap and breech band in one continuous piece for each half, united at B B to form the breeching.

93. HYDRAULIC OIL PRESSES; William R. Fee, Cincinnati, Ohio.
Claim—1st, The peculiar construction of the dies and followers, having the grooves and conduits, and also the oil passages, to facilitate the expression of oil. 2d, The solid truss, when made a part of the press, and worked by means of the rack and pinion. 3d, The hinged hoop for charging the press.

94. CULTIVATORS; J. H. Frampton, Hopewell, Ohio.
Claim—The adjustable share standards attached to the parallel adjustable bars, D D, which are secured to the beam by the bars, E E', arranged as set forth.

95. CHURN DASH; Daniel K. France, Congress, Ohio.
Claim—The metallic strips attached to the convex surface of the slats, by slots and screws, and operating in the manner set forth.

96. CHURN; C. L. Gilpatrick, Saco, Maine.
Claim—The combination of the crank-shafts and staffs with the top, when said top is provided with boxes, in which play slides through which the staffs pass.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On Embroidery by Machinery.** By George Wallis.

(Continued from page 277.)

Discussion.—Mr. Frederick Lawrence inquired whether different colored silks or threads were worked in the machine at the same time.

Mr. Wallis replied that in producing chintz effects, as many colors as might be necessary could be used in different needles, but in getting the shaded effects, as shown in some of the examples, the "trick," for such it really was, of shading the silk in dyeing from light to dark had to be adopted; and thus a certain variety of effect was produced, although this was not always of a very artistic character.

Mr. William Hawes said, looking at this paper, not with the eye of a manufacturer, because he had no knowledge to enable him to form an opinion upon the subject, but as being very interesting in a social point of view, he would offer a few remarks upon one or two matters connected with the subject. The first point which struck him, was that this invention afforded employment to women. It was that peculiar kind of occupation which, whilst stimulating the taste, was capable of becoming a domestic manufacture, and was, therefore, of the greatest benefit to that class which stood most in need of employment. This machine appeared to effect the important end of the economical working of a costly material; for they understood from Mr. Wallis that they could measure, almost to the fractional part of an ounce, the quantity of silk necessary to produce a certain amount of embroidery; and, when that fact was known, all temptation to fraud on the part of the work-people ceased; whereas, in times past, when the silk machines were employed in the houses of the workers, they became a source of constant collision between the employers and the employed, in accounting for the material entrusted to them for the purposes of manufacture. If this machine was capable of doing certain descriptions of embroidery, as well as, or better than, hand labor, and employed persons for whom employment was required, and, at the same time, allowed the manufacturer to entrust a valuable commodity in the hands of the work-people, without fear of fraud—on all those grounds it must be regarded as a valuable addition to our mechanical resources. They had been told that the machine was not, in all cases, capable of producing such perfect results as were obtained by hand labor; but they were likewise told that for some descriptions of goods it produced a better and cheaper article than hand labor could supply. These were points which he thought were especially deserving the attention of the Society; and he considered that they were very much indebted to Mr. Wallis for the clear manner in which he had put before them the benefits which manufacturers and the public might derive from machines of this kind.

Mr. David Chadwick said, although not connected with this branch

* From the Jour. of the Society of Arts, No. 333.

of manufacture, he wished to call the attention of Mr. Wallis to an omission in his paper. He did not hear that any mention was made of a gentleman in Lancashire who had devoted a great deal of attention to embroidery—Mr. Gilbert French, of Bolton. He had visited the works of that gentleman, and had noticed the large number of females who were employed upon this beautiful work, and he had seen specimens of embroidery which, to his eye, were more beautiful and elaborate than those exhibited that evening. Although, as a Manchester man, he felt proud of the honorable mention that had been made of Mr. Houldsworth, yet he thought it would have been well if Mr. Wallis had brought forward some specimens of hand labor in this branch of art, produced by first-class workers of the present day, so as to compare them with the best productions of machine embroidery. As one of the public he thought Mr. Wallis's paper was somewhat defective in some portion of its statistics. He had given them minute particulars of the process by which the work was effected, but he had not given any comparison of the cost of producing these beautiful articles by machinery as compared with that of hand labor. To the public generally it was a matter of little importance by what means a particular article was produced; they were only interested in the economy of the production. Those who purchased these fabrics were astonished at the price at which beautiful table covers could now be obtained, as compared with the cost of similar articles ten or fifteen years ago. He should be glad to hear from Mr. Wallis, if he was able to furnish it, a comparative statement of the cost of producing these articles by hand labor and by machinery. During his (Mr. Chadwick's) visit to Mr. French's establishment, he was informed that that gentleman supplied hand-worked patterns of embroidery of the most costly description, not only to every part of England, but almost to every part of Europe, and that he found, notwithstanding the increasing production of machinery, the demand for hand embroidery work had been constantly advancing.

Mr. Wallis said he feared that Mr. Hawes had misunderstood his remarks as to the increase of domestic employment occasioned by the stimulated production of embroidery in 1847-8. The machines could never be brought into use in the houses of the workers like the sewing machines, as they were of too cumbrous and costly a character. All that was meant in this direction was to call attention to the fact that the demand for hand labor was increased by the action of the machines in cheapening production and thus stimulating demand.

Mr. Hawes said he had merely quoted from the paper itself, which stated, "so far from interfering with the hand labor, it is a fact that, in 1849, there were in London alone some 2000 persons obtaining their living from embroidery who had never done so before, and in Scotland and the north of Ireland some thousands of females were employed in this industry, not in large factories, but in their own houses."

Mr. Wallis continued—With respect to Mr. D. Chadwick's remarks, it happened that Mr. Chadwick was a statist, and he (Mr. Wal-

lis) an artist; both studied figures, but they were of a different kind. He had great respect for figures in arithmetic, and no doubt it would have added to any value there might be in his paper if some comparative statement could have been made as to the cost of production in certain classes of work by machine and hand embroidery. It happened, however, that one or two articles would be no test whatever for any other article, as each would have to be judged of by the quantity of work in each under the precise conditions of its production, for, as shown in the paper, economy in machine embroidery depended upon the greatest use of the needles, and adaptation of the pattern to length of thread, &c. With respect to the excellent productions of Mr. Gilbert French, of Bolton, he (Mr. Wallis) thought he had carefully guarded himself from misapprehension when he stated that his subject was commercial and not artistic embroidery; besides, he had illustrated by a reference to certain examples, the fact that the machine could not produce large and massive patterns of an exceptional character with the same economy as small repeats; nor did he believe that, on the whole, the larger works would possess the artistic qualities of good hand embroidery. His object had not been comparison, but a simple statement of what the embroidery machines could do.

Mr. G. F. Wilson, F. R. S., said there was one point of great interest mentioned in the paper, which had a particular bearing upon the matter which they were all so anxiously discussing—namely, the great Exhibition of 1851. It had been shown that this machine had been first brought out at the national exposition of products at Paris, which was another fact added to the many that had already appeared in the *Journal* of the Society in connexion with exhibitions.

The Chairman remarked that it would be clear to all present that when Mr. Wallis undertook to read this paper, he entered upon a difficulty. When he (the Chairman) first heard the announcement of this paper, he could not conceive how Mr. Wallis could make them comprehend the subject without a machine to illustrate it. But they must all admit that he had explained it well, and that they now really understood how embroidery by machine was accomplished. With regard to the statistics of economy by this process, which had been asked for by Mr. Chadwick, they would understand that in a certain class of goods the economy was twenty times as great as in others. Some of these machines would carry 100 of these needles in one length, and work two frames at the same time—working 200 needles in a simultaneous operation. It appeared that a machine of this description required the attendance of one person to work the pantagraph point, four girls to move the frame, and three others to thread the needles. Thus, they had 200 needles at work with the labor of 8 persons, which made a proportion of 25 needles to 1. In some cases there would be no economy at all in the use of the machines; but it was in such articles as table covers and embroidered cloths that the economy of the machines was most apparent. In the embroidery of one of the table covers exhibited, they would probably have two rows of 96 needles each at work, and from the length of the frame they could work two covers at once;

and, at the same time, the manufacturer had the satisfaction of knowing that he could not be robbed of his silk, as they could calculate almost to a drachm what quantity of silk was consumed in working a particular pattern. Mr. Wallis did not go quite far enough back in his history of the use of these machines. He (the Chairman) remembered that about the year 1834, Mr. Schwabe undertook a very large contract from a city house for embroidered merino dresses; he believed that was the occasion of the first introduction of machine embroidery for ladies' dresses. He might observe that since sewing machines were introduced they had heard very little about distressed needlewomen, and it was evident that the introduction of the embroidery machine had greatly increased the demand for that branch of labor. Machine labor and hand labor acted and re-acted upon each other, the one creating a demand for the other. He had now to propose that which he was sure would be passed with acclamation, namely, a vote of thanks to Mr. Wallis for his interesting paper.

The vote of thanks having been passed,

Mr. Wallis briefly acknowledged the compliment.

The paper was illustrated by a large number of fine specimens of machine embroidery, lent by Messrs. Houldsworth & Co., of Manchester, as well as by several working diagrams prepared by Mr. Wallis. Messrs. Wilson and Newton exhibited their Boudoir Sewing Machine.

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*Heat-conducting Power of Alloys.**†

(Continued from page 190.)

In the *Mining Journal* of last week we gave so much of the paper by Messrs. Crace-Calvert and Richard Johnson as related to the conducting power of pure metals, and now purpose giving a sketch of the remaining portion of the paper, to which, from its elaborate character, it is impossible to do full justice. With respect to the influence of small amounts of impurities on the conducting powers of metals, they thought it would be useful to ascertain the influence which 1 per cent. of a metal exercises when added to another, and these are the curious results obtained with gold and silver:—The conducting power of pure gold was found to be 981, taking silver at 1000, whilst gold with 1 per cent. of silver was only 840. Therefore the addition of 1 per cent. of silver, the best conductor, to gold diminishes its conducting power nearly 20 per cent.

They also examined the influence of carbon on the conductibility of iron, and they found the difference to be about 18 per cent.; thus malleable iron is 436; steel, 397; and cast iron, 359. The influence of a non-metallic substance on a metal is confirmed by the results obtained. Cast copper is represented by 811; with 1 per cent. of arsenic, 570; with 0·5 per cent. of arsenic, 669; and with 0·25 per

*From the London Mining Journal, No. 1232.

†For the information of our non-chemical readers—Sn means tin; Pb, lead; Sb, antimony; Bi, bismuth; Cu, copper; Zn, zinc. Sn 3Cu means 1 part of tin combined with 3 parts of copper, and so on.

cent. of arsenic, 771. The conduction of heat by alloys may be considered under three general heads—1. Alloys which conduct heat in ratio with the relative equivalents of the metals composing them.—2. Alloys in which there is an excess of equivalents of the worse conducting metal over the number of equivalents of the better conductor, and which present the curious and unexpected rule that they conduct heat as if they did not contain a particle of the better conductor.—3. Alloys composed of the same metals as the last class, but in which the number of equivalents of the better conductor is greater than the number of equivalents of the worse conductor; in this case each alloy has its own arbitrary conducting power; the conductibility of such an alloy gradually increases, and tends towards that of the better conductor of the two metals composing the alloy.

The first class are those which conduct heat in the ratio of the conductibility of the metals composing them. This class is represented by the alloys of tin and lead and tin and zinc:—

TIN AND LEAD.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
5 Sn	=73·97	+1 Pb	=26·03	385	386
4 Sn	69.44	1 Pb	30·56	381	381
3 Sn	63·01	1 Pb	36·99	375	372
2 Sn	53·18	1 Pb	46·82	350	350
1 Sn	36·22	1 Pb	63·78	230	236
1 Sn	22·11	2 Pb	77·89	313	317
1 Sn	15·91	3 Pb	84·09	311	309
1 Sn	12·44	4 Pb	87·56	301	304
1 Sn	10·20	5 Pb	89·80	299	301

TIN AND ZINC.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
5 Zn	=73·43	+1 Sn	=26 57	541	572
4 Zn	68·86	1 Sn	31·14	574	564
3 Zn	62·43	1 Sn	37·57	530	551
2 Zn	53·11	1 Sn	46·89	522	532
1 Zn	35·6	1 Sn	64·39	501	495
1 Zn	21·65	2 Sn	78·35	475	467
1 Zn	15·55	3 Sn	84·45	458	451
1 Zn	12·14	4 Sn	87·86	457	447
1 Zn	9·95	5 Sn	90·05	456	442

The above two series of alloys were the only ones which conducted heat as above stated, and from experiments they believe that the metals composing these alloys are simply mixed, and not combined together.

The study of the class of alloys containing an excess of the worse conducting metal being most interesting, they made many experiments to discover why the presence of one metal completely annihilates the conducting power of the other, especially when the latter is the better conductor of the two. The following statements afford an illustration:—

LEAD AND ANTIMONY.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
1 Pb	=61·61	+1 Sb	=38·39	190	251
1 Pb	47·60	2 Sb	52·40	185	237
1 Pb	34·86	3 Sb	65·14	184	225
1 Pb	28.63	4 Sb	71·37	179	219
1 Pb	24·30	5 Sb	75·70	179	215

ANTIMONY AND BISMUTH.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
1 Sb	=37·74	+1 Bi	=62·26	62	110
1 Sb	23·26	2 Bi	76·74	59	91
1 Sb	16·81	3 Bi	83·19	59	83
1 Sb	13·17	4 Bi	86·83	47	77
1 Sb	10·82	5 Bi	89·18	48	75

It will be perceived that the alloys of lead and antimony conduct heat almost as if the square bars examined were composed of pure antimony, for if lead had influenced the passage of heat through the bars, the conducting power of the alloys would have been much higher.

The most important series of this class of alloys are those composed of tin and copper. The results obtained were :—

COPPER AND TIN. Formula of the alloys and percentage.	Silver=1000. Found.	Calc.	COPPER AND TIN. Formula of the alloys and percentage.	Silver=1000. Found.	Calc.
Cu=34·98+ Sn=65·02	415	558	Cu= 9·73+5 Sn=90·27	396	459
Cu 21·21 2 Sn 78·79	431	504	Sn 38 21 3 Cu 61·79	494	670
Cu 15·21 3 Sn 84 79	423	481	Sn 31·73 4 Cu 68·27	155	686
Cu 11·86 4 Sn 88·14	406	468	Sn 27·10 5 Cu 72·90	207	705

The results obtained with one part tin and four parts copper were so extraordinary that the bar first prepared was re-melted and cast, from a fear that there might be in the mass some vacant space, or hole, impeding conduction; but as it yielded the same results when submitted to experiment, they decided to make a new bar, weighing most carefully the metals to be used, and also the bar when cast; the loss being only 0·5 per cent., they were satisfied that the bar was sound, and still it gave the same figures as the bar first experimented with, and, therefore, they concluded that an alloy of tin and copper containing 68 per cent. of the latter metal, has a conducting power five times less than it should have according to theory. From the above results, it is highly probable that these alloys of tin and copper, and especially the three last, are definite chemical compounds; for if they were mixtures they would conduct heat in ratio to the equivalents of the metals composing them, and would not each have a peculiar and different conductibility. These views were substantiated by experiments which they have made with square bars, composed of sectional parts of copper and tin. These bars were made by Mr. Dancer, a very skilful optician, and the parts were soldered together with tin solder, in so thin a layer that it did not occupy a space of 0·25 millimetres in the five junctions. The first three bars they employed were of the usual dimensions, and composed of cubes of copper and tin, each 1 cub. cent., arranged in the following order:—Bar No. 1—2 cubes tin, 2 cubes copper, 2 cubes tin; bar No. 2—2 cubes copper, 2 cubes tin, 2 cubes copper; bar No. 3—cubes of tin and copper alternately. These bars conducted heat nearly as the theoretical results indicate, No. 1 giving 541 (silver=1000), whilst 568 was the theoretical calculation; No. 2 giving 575, 696 being the theoretical number, and No. 3 giving 570 instead of 634. The slight difference being probably due to the tin solder existing between each cube, and to the cubes not being perfect in all their dimensions. They were, however, not prepared for the curious results obtained with a bar composed of two longitudinal bars of tin, soldered to two of copper, and placed in juxtaposition; for although it contained in 100 parts the same weight of tin and copper as the last bar, it conducted heat at quite a different rate; in fact, its conductibility was the same as if the bar had been composed entirely of pure copper, and did not contain half its bulk of tin—this bar (No. 4) gave 829, whilst theoretically it should only have given 634. These interesting results were confirmed by having similar bars made of copper and zinc and copper and lead; the former gave 842,

whilst 731 was calculated; the latter 723, whilst 515 was calculated. They next had a bar (No. 7) made in which there was the same relative weight of tin and copper, but in which the surface of the two metals in contact was only one-half of that in the bar No. 4, and although the results leave some doubt whether the surfaces have an action, the figures are sufficiently different to deserve serious consideration. Although bars 4 and 7 theoretically gave the same results, it was found by experiment that whilst the former gave 829, the latter gave but 757. From their researches they conclude that tin, zinc, and lead exercise a marked action on the conductibility of the copper.

With respect to alloys in which there is an excess of the good conductor, the peculiar properties of the four bronze alloys, Sn 2 Cu, Sn 3 Cu, Sn 4 Cu, and Sn 5 Cu, having already been mentioned, they would have nothing more to add to them if it were not to illustrate the extraordinary influence which tin exercises on the conductibility of copper, and also to show that when there is a great excess of a good conductor in an alloy it overcomes the resistance of the bad conductor, and, in consequence, the conductibility of such alloys increases with the proportion of the good conductor.

TIN AND COPPER.

Formula of the alloys and percentage.	Silver = 1000. Found.	Calc.
Sn=27·10+ 5 Cu=72·90	207	705
Sn 15·68 10 Cu 84·32	307	749
Sn 11 03 15 Cu 88·97	402	768
Sn 8·51 20 Cu 91·40	465	778
Sn 6·83 25 Cu 93·17	475	784

BISMUTH AND ANTIMONY.

Formula of the alloys and percentage.	Silver = 1000. Found.	Calc.
Bi=62·26+ Sb=37·74	62	110
Bi 45·21 2 Sb 54·79	76	132
Bi 35·48 3 Sb 64·52	80	145
Bi 29·20 4 Sb 70·80	96	153
Bi 24·81 5 Sb 75·19	108	159

The influence of excess of equivalents of lead is not so striking. The alloys of zinc and copper do not offer the distinctive degrees of conductibility that the alloys of copper and tin or bismuth and antimony present; but this may be due to the conducting powers of copper and zinc being within a few degrees of each other.

ANTIMONY AND LEAD.

Formula of the alloys and percentage.	Silver = 1000. Found.	Calc.
Sb=38·39+ 2 Pb=61·61	190	251
Sb 23·68 4 Pb 76·32	204	265
Sb 17·20 6 Pb 82·80	221	271
Sb 13·48 8 Pb 86·52	219	274
Sb 11·08 10 Pb 88·92	230	276

COPPER AND ZINC.

Formula of the alloys and percentage.	Silver = 1000. Found.	Calc.
Cu=49·32+ Zn=50·68	688	718
Cu 32·74 2 Zn 67·26	428	687
Cu 24·64 3 Zn 75·36	531	672
Cu 19·57 4 Zn 80·43	589	663
Cu 16·30 5 Zn 83 70	595	657

It is probable that Cu 2 Zn, and Cu 3 Zn are definite compounds, for not only have they a special conducting power of their own far below that of the metals composing them, but also they are perfectly crystallized. The most splendid of all the brass alloys is the alloy Cu Zn, which is of a beautiful gold color, and crystallized in prisms often 3 centims. long. These crystals are also interesting on account of their extraordinary elasticity. It is surprising that so cheap an alloy has not been employed in commerce, for no commercial brass contains more than 30 to 35 per cent. of zinc, whilst the above contains 50·68 of this metal. The only explanation appears to be that

if copper be alloyed with more than 50 per cent. of zinc, the alloys formed do not possess the color of brass, but become white as zinc; and, therefore, manufacturers have never tried to unite these metals in the exact proportions given above. It is remarkable that a variation of a few per cent. in the relative proportions of the two metals no longer yields the beautiful alloy noticed, but only a white and comparatively useless one.

Alloys with an excess of copper gave the following results:—Zn 2 Cu, found 621 (silver=1000), calculated 748; Zn 3 Cu, found 630, calculated 764; Zn 4 Cu, found 666, calculated 770; Zn 5 Cu, found 715, calculated 780. They also thought it useful to analyze the following commercial alloys and determine their respective conducting powers, and the results obtained were—Yellow brass (Cu=64+Zn=56), found 558 (silver=1000), calculated 712; pumps and pipes (Cu=80+Sn=5+Zn=7·5+Pb=7·5), found 426, calculated 707; mud plugs (Cu=80+Sn=10+Zn), found 394, calculated 754; large bearings (Cu=82·05+Sn=12·82+Zn=5·13), found 345, calculated 751. It is extraordinary to find what a low conducting power these alloys possess; for, with the exception of "yellow brass," they do not conduct heat better than wrought and cast iron; this is due to the impurity of the metals employed, and shows the advantage that there will be in substituting for them some of the much cheaper alloys above described. The second part of the paper on "Amalgams" will shortly be published.

Proximate Analysis of Coal Tar. By Mr. Crace Calvert.

From a communication addressed by this gentleman, and read before the Academy of Sciences of Paris, we extract the following account of the constitution of coal tar from different kinds of coals:

	Benzine.	Carbolic acid.	Paraffine.	Naphtaline.	Neutral hydrates of carbon.	Pitch.
Boghead,	12	3	41	0	30	14
Cannel,	9	14	0	15	40	22
Newcastle,	2	5	0	58	12	23
Staffordshire,	5	9	0	22	35	29

Of these substances, he remarks, that the carbolic acid alone possesses any practical amount of antiseptic power. But he finds this substance in so small a proportion as $\frac{1}{1000}$, very valuable as a preservative against offensive putrefactions. He states that the skin of an animal rubbed with carbolic acid on the inside, remained free from vermin for several years.

M. Chevreul reminded the audience that the carbolic acid has also been known under the name of Phenol, Phenic acid, Phenic alcohol, hydrate of phenyle.

For the Journal of the Franklin Institute.

Particulars of the Steamer Champion.

Hull built by Harlan & Hollingsworth & Co., Wilmington, Delaware. Machinery by Allaire Works, New York.—Owner, C. Vanderbilt.—Intended service, Pacific Ocean.

Hull.—		
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		242 feet.
" at load line,		235 "
Breadth of beam, molded,		35 "
Frames—apart at centres, 18 and 20 inches—		
" sketch of shape |—depth 4 ins.—width $1\frac{1}{8}$ ins.		
Plates—15 strakes from keel to gunwale.		
" thickness, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{1}{2}$, and 7-16th inches.		
Cross floors—22 ins. high and 8 ins. apart—$\frac{1}{2}$ and 9-16ths inches thick, and capped with angle iron.		
Keel U—depth 7 ins., dimensions 3-16ths.		
Rivets—diameter $\frac{3}{4}$ inches—apart $2\frac{1}{2}$ inches—single and double riveted.		
Depth of hold,		18 " 2 inches.
" to spar deck,		25 " 10 "
Length of engine room,		66 "
Draft of water forward and aft,		10 "
Tonnage,	1490.	
Area of immersed section at load draft of 10 ft.,	316 sq. ft.	
Contents of bunkers in tons of coal,	500.	
Masts two—Rig—Foretopsail schooner.		
Engines.—Vertical beam.		
Diameter of cylinder,		42 inches.
Length of stroke,		10 feet.
Maximum pressure of steam in pounds,	30.	
Maximum revolutions at above pressure,	20.	
Cut-off—half stroke.		
Weight of engines,	340,000 lbs.	
Boilers.—Two—Return flued.		
Length of boilers,		24 feet.
Breadth "	Furnace,	10 " 6 inches.
	Shell,	9 " 6 "
Height " exclusive of steam chimney,		9 " 6 "
Weight " with water,	190,000 lbs.	
Number of furnaces,	(2 in each.) 4.	
Breadth "		4 " 8 "
Length of grate bars,		7 " 1 "
Number of flues,	above 5.	
	below 10.	
Internal diameter of flues,	below 2 of 21 ins. & 8 of	13 "
	above,	1 " $5\frac{1}{2}$ "
Length of flues,	above,	17 " $4\frac{1}{2}$ "
	below,	11 " 10 "
Heating surface,	2491 sq. feet.	
Diameter of smoke pipe,		5 " 7 "
Height " above grates,		56 "
Consumption of coal per hour,	one ton.	
Paddle Wheels.—		
Diameter over boards,		30 feet.
Length of blades,		6 " 6 inches.
Depth "		18 "
Number "	26.	

Remarks.—One independent steam, fire, and bilge pump—boil-

ers, chimney, and smoke pipe protected from communicating fire, by felt and iron. Three bulkheads; 12 fore and aft keelsons—2 of 42 inches high by $\frac{9}{16}$ths thick, and 10 of 20 inches high by $\frac{9}{16}$ and $\frac{1}{2}$ ins. thick. Stringers on main deck 14 by $\frac{1}{2}$ ins. Deck clamps L 26 by $\frac{5}{8}$ inches; 79 state rooms; 315 steerage berths. Date of trial, September, 1859.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer R. R. Cuyler.

Hull built by Samuel Sneden. Machinery by Allaire Works, New York. Intended service, New York to Savannah.

Hull.—		
Length on deck,		235 feet.
Breadth of beam,		32 "
Floor timbers—at throat *molded* 14 ins., *sided* 10 and 12 ins.		
Frames—*apart at centres* 24 inches.		
" strapped with diagonal and double laid iron straps 4 by $\frac{5}{8}$ inches.		
Depth of hold,		16 " 6 inches.
" to spar deck,		23 " 3 "
Length of engine, boiler, and coal space,		66 "
Draft of water at load line,		18 "
" below pressure and revolutions,		18 "
Area of immersed section at this draft,	548 sq. ft.	
Tonnage, custom house,	1600.	
Contents of bunkers in tons of coal,	150.	
Masts and rig—Foretopsail schooner.		
Engines—Vertical direct.		
Diameter of cylinder,		70 inches.
Length of stroke,		4 feet.
Maximum pressure of steam in pounds,	25.	
Cut-off at one half stroke.		
Maximum revolutions per minute,	45.	
Boilers—Two—Horizontal tubular.		
Length of boilers,		17 feet 4 inches.
Breadth "		13 " 6 "
Height " exclusive of steam chimney,		13 " 9 "
Number of furnaces,	6.	
Breadth of furnaces,		3 " 11 "
Length of grate bars,		7 " 6 "
Number of tubes,	288.	
Internal diameter of tubes,		4 "
Length of tubes,		14 "
Heating surface, (fire and flues,)	6285 sq. ft.	
Diameter of smoke pipes,		4 " 4 "
Height "		21 "
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per hour,	0·71 tons.	
Propeller.—		
Diameter of screw,		16 feet.
Length of blades,		4 " 9½ inches.
Pitch of screw,		22 " 6
Number of blades,	4.	

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steam Ferry Boats Marion and Gen. Warren.

Hulls built by Rosevelt & Joyce. Machinery by Novelty Iron Works, New York. Intended service, New York to Brooklyn.

Hull.—		
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		142 feet 6 inches.
Breadth of beam at midship section,		33 "
Floor timbers, at throat—*molded*, 13 ins.—*sided*, 5½ ins.		
Frames—*apart at centres*, 24 ins.		
Depth of hold to spar deck,		12 " 4 "
Length of engine and boiler space,		59 "
Draft of water at load line,		6 "
Draft of water at below pressure and revolutions,		6 "
Area of immersed section at this draft,	170 sq. ft.	
Tonnage, custom house,	521.	
Engine.—Vertical beam.		
Diameter of cylinder,		38 inches.
Length of stroke,		9 feet.
Maximum pressure of steam in pounds,	25.	
Cut-off, at		4 " 6 "
Maximum revolutions per minute,	28.	
Weight of engines and wheels *in pounds*,	63,700.	
Boiler.—One—Cylinder, with drop return flues.		
Length of boiler,		25 feet.
Weight " without water, *in pounds*,	31,159.	
Number of furnaces,	2.	
Breadth "		3 " 10 inches.
Length of grate bars,		6 " 10 "
Number of flues,	16.	
Internal diameter of flues,	14 of 14 ins., 2 of 24 ins.	
Length of flues, upper and lower,		13 " 5 "
Length of flues, centre,		11 " 3½ "
Heating surface (fire and flue),	1198 sq. ft.	
Diameter of smoke pipe,		3 " 4 "
Height " from top of boiler,		40 "
Description of coal,	Bituminous.	
Draft,	Natural.	
Paddle Wheels.—		
Diameter,		18 feet 6 inches.
Length of blades,		8 "
Depth "		24 "
Number "	18.	

C. H. H.

Straw Matting.

The Abbè Moigno notices in the *Cosmos* the introduction of a new article, which is a tissue of straw, made of indefinite length, and of any breadth not greater than one metre, ($1\frac{1}{12}$ yards.) It is made by uniting plaits of the straw by thread of preserved hemp or galvanized on tin wires. The fabric is made in a loom, and at the rate of 100 sq. yards per day by a single skilled workman. These mattings are extensively used to protect the vineyards and gardens, and experience seems to show that they form a very valuable improvement.

Cosmos, 1st July, 1858, p. 8.

For the Journal of the Franklin Institute.

Particulars of the Steam Ferry Boats Ethan Allen and Commodore Perry.

Hulls built by Thomas Stack, Williamsburgh. Machinery by Novelty Iron Works, New York. Intended service, New York to Brooklyn.

HULL.—		
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		144 feet 6 inches.
Breadth of beam,		33 "
Floor timbers, at throat—*molded*, 13 ins.—*sided*, 5½ ins.		
Frames—*apart at centres*, 24 inches.		
Depth of hold,		12 "
Length of engine and boiler space,		59 " 6 "
Draft of water at load line,		6 "
" below pressure and revolutions,		6 "
Area of immersed section at this draft,	170 sq. ft.	
Tonnage,	527.	
ENGINE.—Vertical beam.		
Diameter of cylinder,		38 inches.
Length of stroke,		9 feet.
Cut-off at,		4 " 6 "
Maximum pressure of steam in pounds,	25.	
" revolutions per minute,	28.	
Weight of engines *in pounds*,	63,700.	
BOILER.—One—Drop flued.		
Length of boilers,		25 feet.
Breadth "		9 "
Weight " without water,	31,159 lbs.	
Number of furnaces	2.	
Width "		3 " 10 inches.
Length of grate bars,		6 " 10 "
Number of flues,	16.	
Internal diameter of flues,	14 of 14 ins., 2 of 24 ins.	
Length of flues, { upper,		13 " 5 "
Length of flues, { lower,		11 " 3½ "
Heating surface,	1198 sq. ft.	
Diameter of smoke pipe,		3 "
Height "		40 "
Description of coal,	Anthracite.	
Draft,	Natural.	
PADDLE WHEELS.—		
Diameter,		18 feet 6 inches.
Length of blades,		8 "
Depth "		2 "
Number "	18.	

C. H. H.

Persistent Activity of Light.

In former numbers of our *Journal* we have given an account of the extraordinary experiments of M. Niepce de St. Victor, by which it was shown that when a sheet of paper impregnated with certain substances, (*i. e.* tartaric acid,) is exposed to the solar light and then enclosed in a perfectly tight box, a photographic action takes place, by which pictures may be printed as though in the light.

This subject has been farther investigated by M. l'Abbè Laborde,

who is led by his experiments to conclude that the active agent "is an emanation, not a radiation."

The following are two of his experiments:

I. The sensitive paper was partly covered by a glass plate in contact with it; another plate of glass or ivory was placed across the first, so as to oppose the direct radiation from the part which it covered, but not to the circulation of any vapors emanated; when the box was opened, the paper was found evenly blackened throughout, except under the glass in contact with the paper.

II. The box containing the insolated sheet was left for four hours in a warm place. M. Laborde then opened it carefully, and holding the opening downwards, gently withdrew the sheet; then quickly fixing the sensitive paper upon the cork, he re-closed the box and placed it in a cool place. When it was again opened, after twelve hours, the sensitive paper was found blackened, notwithstanding the absence of the insulated sheet.—*Cosmos.*

For the Journal of the Franklin Institute.

Further Performance of the U. S. Steam Sloop "Wyoming."

In the last number of this *Journal* (p. 267), the results of the engineers' trial trip of this ship were given. Since which, the ship having departed on a cruise to the Pacific, the capacity of her machinery was tested in the Delaware Bay, and the result reported from the Breakwater. On this occasion, the coal used was "Broad Top," mined in Pennsylvania, a "semi-bituminous" coal, free from sulphur, emitting no smoke except when freshly fired, and of free burning properties. The draft of the ship was greater than on the previous trial, viz:—

Forward, ... 13 feet 3 inches.
Aft, ... 13 " 4 "

During the passage down the Delaware, the following is the

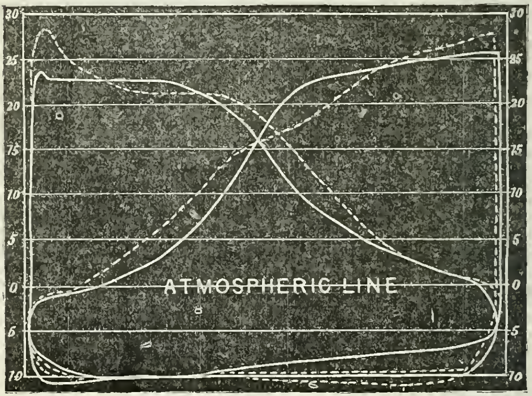
STEAM LOG.

Hour.	Steam pounds.	Vacuum inches.	Throttle open.	Cut-off inches.	Coal pounds.	Revolutions per minute.
9 to 10	27	25·0	·28	Variable from 12·5 to 15·5. Averaging 14 inches.	3136	67·1
11	26	23·0	·40		3584	73·0
12	26	23·0	·40		1792	75·1
1	25	23·5	·40		1000	73·0
2	25·5	23·0	·55		1240	76·1
3	24	23·0	·40		1755	69·0
4	25	23·2	·40		2223	75·3
5	24	23·0	·40		2680	69·2
	25·25	23·34	·39	14·0	1897	72·3

Average H. P. developed in whole time, . 791·54 (calculated.)
" coal per H. P. per hour, in pounds, . 2·40 including spreading fires.
Highest H. P. developed by indicator diagram, 1088·7 at 80½ revolutions.
" number of revolutions per minute, 85.
All the furnaces (14) were in use during this time.

The following diagrams show the performance of the engines at the time the above power was indicated.

Forward Engine. (Full lines.)		*After Engine.* (Dotted lines.)	
Date and hour,	Oct. 5, 1·5 P. M.	Date and hour,	Oct. 5, 1·5 P. M.
Revolutions per minute,	80·5	Revolutions per minute,	80·5
Pressure of steam,	27·0	Pressure of steam,	27·0
Throttle valve,	wide.	Throttle valve,	wide.
Vacuum,	23·5	Vacuum,	23·5
Cut-off,	15 ins.	Cut-off,	16 ins.
Mean pressure,	22·09	Mean pressure,	23·22
Indicated H. P.,	528·88	Indicated H. P.,	559·89



The speed of the ship at the above deep draft (having 266 tons of coal on board at starting), was 10·58 geographical miles per hour, and when the above cards were taken, the log showed a speed of 11·25 knots per hour. The slip of the screw averaged 20·6 per cent.

On the outward trip to Charleston reported in the last number of the *Journal*, the slip was 16 per cent., the ship drawing on an average 13 feet aft, 12 feet forward.

On the homeward trip the slip was 19·1 per cent., the ship drawing on an average 12 feet 8 inches aft, 11 feet 10 inches forward.

It would thus appear that at sea the slip would average in smooth weather and half coal in, about 17 to 18 per cent.

Evaporation of the Boilers.

By reference to the indicator diagram taken during the homeward passage from Charleston (*vide* p. 271), and to that of the after engine at the same time (not published), it appears that, by averaging all

four ends, the actual point of cutting off was 10·2 inches, and the initial pressure of steam entering the cylinders, 15·3 pounds above the atmosphere, of which the volume is 880.

The total clearance and space in ports for each end equals 1·9 inches of stroke.

The volume of steam used, by the diagrams, was therefore $10{\cdot}2+1{\cdot}9=12{\cdot}1$ inches of stroke, or for four ends, $12{\cdot}1\times 4=48{\cdot}4$ inches; and, as the area of each cylinder is 1964 sq. inches, the volume was $1964\times 48{\cdot}4\times 72$ revolutions $=6844104$ cubic inches $=3960$ cubic feet of steam; $\frac{3960}{880}=4{\cdot}50$ cubic feet $\times 62{\cdot}5=281{\cdot}5$ pounds of water per minute.

The coal consumed averaged 2·73 pounds per hour per H. P., or $\frac{2{\cdot}73\times 640{\cdot}8}{60}=29{\cdot}15$ pounds per minute. Hence $\frac{281{\cdot}5}{29{\cdot}15}=9{\cdot}65$ pounds of water evaporated by one pound of fuel.

By the diagrams given above, the mean point of cutting off in all four ends was 13·7 inches; and the mean entering pressure, 22·8 pounds above the atmosphere, of which the volume is 717. Hence $\frac{13{\cdot}7+1{\cdot}9=15{\cdot}6\times 4\times 1964\times 80{\cdot}5}{1728}=5709$ cubic feet of steam per minute; $\frac{5709}{771}=7{\cdot}404\times 62{\cdot}5=462{\cdot}75$ pounds of water per minute.

As this trial was too short to indicate the correct hourly consumption of fuel, the rate per H. P. per hour may be assumed as the same as previously found, viz: 2·73 pounds; and the consumption would then be $\frac{1088{\cdot}7 \text{ H. P.}\times 2{\cdot}73}{60}=49{\cdot}5$ pounds of coal per minute. Therefore $\frac{462{\cdot}75}{49.5}=9{\cdot}32$ pounds of water per pound of fuel, as the rate of evaporation.

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*Gilding Textile Fabrics.**

Gold stuffs are generally manufactured by weaving gold thread, which renders the tissue stiff and heavy. M. Burot has just discovered a method of gilding stuffs by means of electrical agency. The piece to be gilt, whether made of silk or any other material, is dipped into a solution of nitrate of silver and ammonia; after remaining in this solution a couple of hours, the stuff is taken out, and when dry exposed to a current of pure hydrogen gas, which reduces the salt, and leaves the silver in a metallic state on the stuff. A silvered surface is thus obtained, which is easily gilt over by the usual galvanoplastic methods. Beautiful specimens of gilt and silvered lace were exhibited in London some five years since. They were of French origin, but the process was not made known.

* From the Lond. Mechanics' Magazine, January, 1859.

For the Journal of the Franklin Institute.

Remarks on the Aurora of August 28th, 1859.

By Benjamin V. Marsh.

In this, as in other great auroral displays, there were evidently two systems of bodies or appearances situated in planes nearly at right angles to each other.

First. *Horizontal* bands of dense whitish cloud, stretching across the heavens in nearly an east and west direction, in the form of arches.

These were few in number; but the spaces between them were mostly occupied by numerous fragments and narrow irregular streams of the same material, running parallel to the bands—the whole forming a kind of luminous curtain, covering more than three-fourths of the visible heavens, leaving only segments of clear sky near the northern and southern horizons.

Second. *Vertical* "streamers" of great brilliancy and splendor in the form of columns having their bases in the horizontal curtain, and extending up from it to immense heights, and visible *through* the luminous curtain.

A scene changing so frequently and rapidly, was, of course, very unfavorable for accurate measurements, but fortunately the southern margin of the luminous curtain, as seen from Philadelphia and vicinity, remained well defined and nearly stationary for more than three-quarters of an hour, commencing at half past 8 o'clock or earlier, thus affording a good opportunity for determining its position.

As to its elevation above the southern horizon during this interval, I have the following information:—

1. At Newburyport, Mass. Latitude 42° 48½′.

An article signed "*P*," in the *Newburyport Herald* of August 30th, in the course of a careful and detailed account of its progress, says that at 9 o'clock (8¾ Philadelphia time), "Lambda Scorpii marked its southern border."

The altitude of Lambda Scorpii at 9 o'clock at Newburyport was 5¾ degrees; and a great circle passing through this star at that time, and cutting the horizon at the east and west points, crossed the meridian at an altitude of 6 degrees, which must correspond very nearly to the altitude of the highest point of the margin of the curtain above the southern horizon.

2. At New Haven, Conn. Latitude 41° 18′.

Prof. C. S. Lyman and Mr. E. C. Herrick ascertained its minimum elevation between half past 8 and 9 o'clock to be from 10½ to 12 degrees.

3. At Burlington, N. J. Latitude 40° 5′.

Samuel J. Gummere *estimated* its altitude between half past 8 and 9, to be from 18 to 20 degrees, but made *no measurements*.

4. At Philadelphia. Latitude 39° 57′.

Soon after half past 8, Charles J. Allen carefully noted its position between two fixed objects, and afterwards ascertained by actual mea-

surement that this gave an elevation of about $22\frac{1}{2}$ degrees above the southern horizon.

5. At Sandy Spring, Md. Latitude 39° 9′.

Prof. Benjamin Hallowell of Alexandria, says, "the elevation of the southern margin of the luminous curtain above the southern horizon, I thought, and mentioned to those with me, was about the meridian altitude of the equator, say 51 degrees."

Assuming the direction of the southern margin of the curtain to have been due east and west, and calculating its height and position from the above data, I find the following results.—

	HEIGHT IN MILES.	LAT. SOUTH. MARGIN.
Newburyport 6, and New Haven $10\frac{1}{2}$, give,	49·9	38° 0′
" 6, " " $11\frac{1}{4}$, "	41·3	38 $39\frac{1}{2}$
" 6, " " 12, "	35·8	39 6
" 6, " Burlington 18, "	49·3	38 3
" 6, " " 19, "	46·5	38 15
" 6, " " 20, "	44·3	38 $25\frac{1}{2}$
" 6, " Philadelphia $22\frac{1}{2}$, "	43·2	38 31
New Haven $10\frac{1}{2}$, " Burlington 18, "	48·7	38 $4\frac{1}{4}$
" $10\frac{1}{2}$, " " 19, "	43·9	38 $21\frac{1}{4}$
" $10\frac{1}{2}$, " " 20, "	40·4	38 34
" $11\frac{1}{4}$, " " 18, "	59·6	37 39
" $11\frac{1}{4}$, " " 19, "	52·5	38 2
" $11\frac{1}{4}$, " " 20, "	47·5	38 $18\frac{3}{4}$
" 12, " " 18, "	74·2	37 $6\frac{1}{2}$
" 12, " " 19, "	63·5	37 38
" 12, " " 20, "	56·3	38 0
" $10\frac{1}{2}$, " Philadelphia $22\frac{1}{2}$, "	38·9	38 $39\frac{1}{4}$
" $11\frac{1}{4}$, " " $22\frac{1}{2}$, "	44·6	38 28
" 12, " " $22\frac{1}{2}$, "	51·5	38 15
Sandy Spring 51, " Newburyport 6, "	41·1	38 $40\frac{3}{4}$
" 51, " New Haven $11\frac{1}{4}$, "	40·9	38 41
" 51, " Burlington 19, "	32·8	38 $46\frac{1}{2}$
" 51, " Philadelphia $22\frac{1}{2}$, "	36·5	38 44
Average,	47·1	38° $18\frac{1}{4}$′

The above table is intended to exhibit the whole range of results from the preceding data, but the following are, no doubt, the most reliable items.

	HEIGHT IN MILES.	LAT. SOUTH. MARGIN.
Newburyport 6, and New Haven $11\frac{1}{4}$, give,	41·3	38° $39\frac{1}{2}$′
" 6, " Philadelphia $22\frac{1}{2}$, "	43·2	38 31
New Haven $11\frac{1}{4}$, " " $22\frac{1}{2}$, "	44·6	38 28
Average,	43·0	38° 33′

The position of the corona has usually been observed to correspond with that of the pole of the dipping needle (which, at Philadelphia, is about 18 degrees south of the zenith), indicating that the tops of the streamers are inclined southward, at an angle of 18 degrees from a vertical position.

Assuming this to have been true in this instance, and that the streamers had their bases in the curtain at the height of 43 miles, observations made in Cuba, and published in the "*Diario de la Marina*" of August 30th, give us the means of determining their position and length.

At Havana no mention is made of the arch or curtain (which was, doubtless, below the Cuban horizon), but the streamers are described as ascending to the height of the pole star.

At Burlington several streamers were observed issuing from the southern side of the corona, but none approached within 45 degrees of the southern horizon. Therefore their bases, if only about 43 miles high, could not have been south of the 39th parallel of latitude. The entire absence of auroral light below the arch, proves these to have been the *only* streamers south of Burlington in this longitude, and, consequently, that they were probably the *identical* streamers seen in the north by the Cubans.

Supposing, then, that they sprang from the curtain in latitude 39°, and that, as seen from Havana, they had an elevation equal to that of the pole star, I find their length 578 miles, and that their tops were situated nearly in latitude 36° 47′, at a vertical height of 596½ miles.

This would give Norfolk as the most southern point at which the streamers would appear to reach the zenith—the display at all places further south being confined to the northern heavens.

Among the most constant features of the display at Burlington, were two large irregular masses or patches of light, remaining pretty nearly stationary during most of the evening, one in the east, and the other about 15 degrees north of west, each at an elevation of from 10 to 20 degrees above the horizon, varying greatly in color and brightness, but evidently sympathizing with each other in all their changes.

The east and west bands seemed to terminate in these masses which were evidently the places of convergence of the parallel streams composing the curtain, but their brilliancy and the variety of their colors were far too great to be due to these whitish streams alone.

Prof. B. Hallowell, of Alexandria, says, "There appeared to be two foci of auroral light maintaining pretty nearly a constant position the greater part of the evening, but varying materially in color at different times, and also in the number and brightness of the streamers issuing from them. We thought one of them was a little north of west, and the other a little south of east. I should judge the centre of each to have been about 10 degrees above the horizon."

The *Steubenville Ohio Journal*, of August 30th, speaks of "the two centres in the north-east and the north-west, with a fitful gleam between them."

In England the lights in the north-east and south-west, particularly the latter, attracted general attention, and were, in some instances, supposed to arise from a great conflagration ; and various accounts in this country refer to the luminous clouds in the east and west; from all which it is evident that the phenomenon was not local but general.

At Burlington, during a considerable time (probably thirty minutes

and perhaps much longer), preceding half past 9, a segment 10 or 15 degrees in height over the northern horizon, was perfectly free from the aurora, showing the limit of the curtain in that direction. This margin, however, was neither so regular nor so well defined as the southern.

The correspondent "*P*," of the *Newburyport Herald*, already quoted, says, "At a quarter before 10" ($9\frac{1}{2}$ Philadelphia time), "the northern border of a luminous arch passing from east to west, was marked by Nu in the right foot of the Swan, while the whole southern and south-western heavens were glowing with streamers rushing to the elevated pole of the magnetic dip, *the whole northern heavens being entirely destitute of auroral light.*"

Since Nu Cygni was then nearly in the zenith, it appears from the above that, previous to half past 9, Philadelphia time, the northern border of the curtain was vertical over Newburyport. Consequently the total width of the curtain at this time, must have been only four and a half degrees of latitude, or about 315 miles.

In England the prevalence of clouds interfered with complete observations, but from the *London Times* we learn that Mr. Lowe noted a splendid display at half past 2 (corresponding with half past 9, Philadelphia time, its period of maximum brilliancy in this country, and thus proving the phenomena to be identical), and that an observer at Brighton saw a band stretching from south-west to north-east by east.

At Stockton, California, the *San Joaquin Republican* of August 31st, says, "It appeared about 9 o'clock as a faint white light commencing about north and extending to about east by north. In about 10 minutes later great streams of red and blue shot up all along the north-eastern horizon, but they appeared to shoot up highest about midway of the light."

A consideration of all the preceding statements seems to justify the conclusion that the luminous horizontal curtain was in the form of a ring, the centre of which was probably situated in or near the northern part of Davis' Straits—its direction having been shown to be nearly north-west from England, a few degrees east of north from Philadelphia, and north-east from California—that this ring was about 43 miles from the earth, and that its width, previous to half past 9 o'clock, was about 315 miles; and furthermore, that from various points on its surface, arose splendidly illuminated vertical columns several miles in diameter, and near 600 miles high, and that these columns were at all times at very considerable distances from each other—one streamer for every five hundred square miles being more than sufficient to satisfy all observations.

We have, therefore, overlying the annular curtain, an annular stratum or zone 550 miles in thickness, composed entirely of vertical streamers, the whole forming a thick ring having the curtain for its lower boundary; and I think it is to these vertical streamers that we must look for the cause of the fixed masses of light in the east and west.

It will be recollected that these were conspicuous during nearly the whole evening, although the display of streamers was, during a great part of the time, quite limited. Now, an observer at Philadelphia in looking north, looks across the ring and through a comparatively moderate thickness of streamers, even when viewing a point as much as 45 degrees above the horizon; but, in looking east or west, he looks through the same lengthwise, and consequently through a very great thickness of the streamer-bearing zone.

The result is, that in the north he sees an occasional streamer comparatively near to him, and therefore distinctly defined, while towards the eastern horizon the light of a great many very distant streamers is so completely blended as to give the effect of a diffused and steady brightness.

Had the curtain with its overlying stratum of streamers extended indefinitely east and west, the brightness would probably have been about the same at the horizon (except so far as affected by the want of perfect transparency in the atmosphere), as at 10 or 20 degrees above it, the greater distance of the streamers from the eye being counterbalanced by their greater number. But, in this instance, the curtain being in the form of a ring of comparatively small diameter, its curvature carried it greatly to the northward before the whole thickness reached the horizon—the southern margin of the upper surface of the ring only reaching the horizon when as far north as the centre of the fixed light. Consequently, south of this point the depth of streamers looked through at the horizon, must diminsh rapidly (without a corresponding diminution at greater elevations), and the light speedily vanish.

This corresponds with the phenomena as observed, and we may therefore conclude that these "foci" in the east and west, although coinciding in position with the places of convergence of the horizontal streamers, derive their color and brilliancy chiefly from vertical streamers, and that if the streamer-bearing curtain had extended indefinitely northward, we should have observed the same phenomena in that direction also.

It should be remarked, that if the centre of the ring had the place I have assigned it, some changes must be made in my calculations for determining the height, which will tend slightly to increase it.

The sudden projection of the streamers to such vast heights from the curtain, seems to bear a striking analogy to the formation of the tails of comets, and suggests the inquiry whether they are not, in like manner, the effect of a repulsive force.

Philadelphia, October 18th, 1859.

On the Freezing Point of Water in Capillary Tubes.

Many years ago M. Donnè showed that water enclosed in narrow tubes of a substance capable of being wetted by it, might be raised to a temperature considerably above 212° without boiling—and these experiments have been made the basis of several attempts to account for the

explosions of steam boilers. Mr. H. C. Sorby, in a note communicated to the London, Edinburgh, and Dublin Philosophical Magazine, completes these researches by showing that in capillary tubes, the temperature of water may be lowered far below 32° without freezing even when the tubes are shaken. In tubes of from $\frac{1}{200}$ or $\frac{1}{300}$ inches in diameter, the water may be reduced to 5° Fah., without freezing, provided it be not in contact with ice. These experiments go to show that these phenomena are caused by the adhesion of the water to the walls of the tube interfering with its change of state; and thus lead to the belief that they have no application to water in large vessels, such as steam boilers.

New Disinfecting Powder.

MM. Corne and Demeaux propose as a powerful disinfectant, a mixture of powdered plaster of Paris, with two or three per cent. of coal tar. M. Velpeau, the celebrated surgeon, and director of the Hospital *La Charité*, speaks of it in the most energetic terms as perfectly successful in disinfecting the most offensive ulcers, (to which it is applied as a plaster,) and assisted their healing; and in rendering entirely inodorous the masses of semi-putrescent matters in the dissecting room. So highly did he think of its value, that he urged the Academy of Sciences to waive their usual rule of awaiting the report of their Committee, and to recommend the Minister of War at once to use it for the wounded in the late Italian war.—*Cosmos*, July 22, 1859, p. 106.

New Material for Buttons.

Excellent buttons and even handsome cameos may be made with talc or steatite, provided after they are made they be heated for several hours at a nearly white heat. By this strong calcination, the steatite gets so hard that it strikes fire with flint, and resists the best tempered file. They may be polished by emery, tripoli, and jeweler's putty; and colored by mineral or organic matters; chloride of gold colors them purple; nitrate of silver, black; exposure to the reducing flame increases very much the brilliancy of the color.

Cosmos, July 22, 1859, p. 92.

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*Coal Supply of Great Britain.**

The coal fields of Great Britain yield nearly 70,000,000 tons per year. A better idea of the immense commerce of England could not be formed than by stating the fact that at Manchester and its environs a motive steam power equal to 1,200,000 horses is constantly maintained, to support which there are consumed 30,000 tons of coal per day, or 9,500,000 a year. In the manufacture of salt alone, about

*From the Lond. Practical Mechanics' Magazine, April, 1859.

3000 tons are consumed per day, or 950,000 a year. The Transatlantic steamers from Liverpool and other ports consume 700,000 tons per year, and the manufacture of gas absorbs at least 10,000,000 tons per year. The export of coal from England reached, in 1858, 6,078,000 tons. It is estimated that England alone could furnish enough coal for the consumption of the whole of Europe for the space of 4000 years.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 20, 1859.

John Agnew, Vice-President, in the chair.

John F. Frazer, Treasurer.

Daniel R. Ashton, Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Geographical Society, London; the K. K. Geographischen Gesellschaft, Vienna, Austria; and Capt. C. Wilkes, U. S. N., Washington, D. C.

Donations to the Library were received from the Royal Geographical Society, and the Chemical Society, London; L. A. Huguet-Latour, Esq., Montreal, Canada; Capt. C. Wilkes, U. S. N., Washington, D. C; and from Prof. John C. Cresson, and the American Philosophical Society, Philadelphia, Pa.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of September, was read.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (17) were proposed, and the candidates proposed at the last meeting (6) were duly elected.

Mr. Howson exhibited a specimen of C. Sharp's breech-loading repeating pocket pistol. It consists of a barrel block having four bores, the block being arranged to slide along the stock to and from the breech, which is stationary. When the barrel block is slided out, a metallic cartridge is inserted into each bore, and the barrel block pushed back and locked against the breech. A very ingeniously contrived rotating nipple on the hammer, strikes one corner of each cartridge in succession. Mr. Howson remarked that more accurate aim could be taken with this pistol than with an ordinary revolver, and that it could be as rapidly loaded and discharged. Patents have been granted in this country, England, France, and Belgium for Mr. Sharp's invention.

Mr. Howson also exhibited a specimen of Mr. Warburton's patent perforated hat. The novelty in this invention consists in using heated points for making the perforations. In piercing the body of the hat with these points, the shellac stiffening melts and a clear hole is made through the body without breaking or crushing the material of which the body is made.

Mr. H. also exhibited J. Higginbotham's improved stop valve, in which the ordinary screw spindle is dispensed with and the valve raised and lowered by means of a cam. The object of this invention is to prevent the leaking of the stuffing box caused by the screw spindles of ordinary stop valves, and to afford facilities for grinding the valve to its seat.

In reply to a question by a member, "If any plan to propel the cars on City Passenger Railroads had been proposed in lieu of horses," it was stated by one of the Committee on Meetings, that the Caloric or Hot Air Engine was about to be applied to that purpose in New York, the first machine being nearly ready for trial; and, from the known fertility of resources possessed by the engineer making it, but little doubt of its success might be entertained.

Another means of propulsion seems to have been hit upon by several persons, as soon as the necessity for some cheaper motor than horse flesh became apparent. The directors of two or three roads, on application, were advised to use compressed air, operating engines of small cylinder capacity, running quickly, and supplied with air of a high density; the motion being transmitted through geared wheels to the driving axles. With either of these plans no change would be required in the existing cars, as the engines could be suspended beneath the floors, or on one of the platforms, whilst the air reservoirs could be placed on either side of the car, and form the seats. If reservoirs of a capacity sufficient to maintain a working pressure during the entire run could not be had, they might be refilled at some intermediate point, say at the intersection of a cross road, where the compressing engines and supply reservoirs might be stationed, thus serving two roads: the time occupied in filling the reservoir being merely that consumed in making the attachment, say one minute. The heavy grades on some of the roads can be overcome by a change of gear wheels operated by the engine man; the engines running at usual speed, whilst that of the car is reduced one-half or one-third. The objections urged against the use of steam, as, danger of explosion, heat and smoke, are nearly removed, whilst the exhaust motor being invisible would give no fright to horses. Vehicles could be warned off the track by an air-whistle, and the approach to a crossing or a connecting road made known. It is said that an air engine is being built for a Philadelphia road by a competent engineer who has just completed a successful locomotive engine driven by compressed air, for a road in the mining region. It has two cylinders of moderate capacity supplied with air of 200 ℔s. initial pressure, contained in a reservoir of about 75 cubic feet. With the above pressure it ran about 2000 feet, pushing six loaded drift-cars upon which were clustered over 50 men. No novelty is claimed in the use of compressed air as a motor, numerous experiments and successful workings being recorded in books; but it seems to be specially adapted to this purpose, and will, no doubt, much reduce the running expenses of cars, each of which requires six horses per day to make its usual trips.

Abstract of Meteorological Observations for August, 1859; made in Philadelphia, Somerset, Dauphin, Adams, and Centre Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

1859. Aug't.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Relative humidity. 2 P. M.	Force of vapor. 2 P. M.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.	Direc.
1	29·830	·079	74·7	25	3·0	47	·543		S W.
2	29·836	·044	79·7	24	6·0	40	·608		S E.
3	29·838	·029	83·7	23	4·0	55	·845		S E.
4	29 738	·100	84·3	25	2·7	62	1·014	0·656	S.
☾ 5	29·717	·035	78 7	12	5 7	67	·886	0·178	S W.
6	29·83	·116	76·7	17	4·0	43	·482		W.
7	29·781	·056	78·0	25	2·0	45	·555		S W.
8	29 810	·040	78 7	21	2·0	40	·528		S E.
9	29·979	·169	76·3	23	2·3	44	·548		E.
10	29·974	·006	75·8	21	2·2	48	·550		E.
11	29·911	·063	74·5	22½	1·3	48	·538		S E.
12	29 822	·089	76·2	15	2 7	61	·665	0·278	S.
○ 13	29·713	·109	79·0	15	2·8	63	·717	0·831	S S W.
14	29·698	·016	80·0	17½	1·0	63	·683		N E.
15	29·762	·065	78·5	15	1·5	57	·662		N E.
16	29·941	·179	70·5	15	8·0	46	·408		N E.
17	29·956	·026	68·2	10	2·3	43	·374		N E.
18	29·836	·120	70·8	25	3·0	37	·381		(var.)
19	29·733	·103	73·0	24	2·2	31	·337		S W.
20	29·852	·118	71·7	15½	1·3	34	·347		(var.)
☽ 21	29·914	·063	72·0	24½	1·7	36	·367		N E.
22	29.932	·025	71·0	25	1·0	38	·402		(var.)
23	29·939	·036	72·2	24	1·2	49	·633		S E.
24	29·770	·170	74 0	13½	6·2	90	·798	1·483	S W.
25	29 735	·045	75·7	19	5·0	47	·543	0·460	N W.
26	29·804	·069	74·8	22½	1·5	44	·530	0 307	S W.
27	29·776	·028	74·7	20½	2·2	52	·583		W.
● 28	29 797	·022	60·0	12	7·3	63	·465		W N W
29	29·845	·048	63·3	21½	6·3	49	·370		N W.
30	29·816	·029	66·0	21	2·7	36	·317		N W.
31	29·740	·076	68·8	27	2·8	47	·464	0·315	S W.
Means	29·827	·070	74·5	20½	3·1	50	·551	4·447	S26¼°E

SOMERSET, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer. — HARRISBURG, Dauphin Co. 40° 16′, N. 76° 15′, W. JOHN HEISELY, M D., Obs.

Aug't.	Somerset Bar. Mean.	Somerset Ther. Mean.	Somerset Relative humidity. 2 P. M.	Somerset Force of vapor. 2 P. M.	Somerset Rain.	Somerset Prevail'g winds	Harrisburg Bar. Mean.	Harrisburg Ther. Mean	Harrisburg Rain.	Harrisburg Prevail'g winds.
	Inch.	°	Per ct.	Inch.	Inch.	Direc.	Inch.	°	Inch.	Direc.
1	27·612	72·3	60	·649		S W.			2·362	S.
2	27·649	72·3	67	·730		S W.	29·725	78·7	0·165	S.
3	27·675	75·7	52	·720		(var.)	29·735	83 3		S.
4	27·603	75·0	81	·730	1·948	S W.	29·594	85·0	0·243	S W.
5	27·612	70·7	71	·671		W.	29·615	79·3		W.
6	27·706	63·0	64	·554		W N W	29·752	75·7		W.
7	27·661	67·0	62	·611		W.	29·675	76·3		W.
8	27·724	70·7	47	·588		E.	29·759	80·3		W.
9	27·787	75·7	63	·708		W.	29·879	81·3		W.
10	27 773	78·0	68	·801		S E.	29·876	81·3		S E.
11	27·706	75·0	64	·774	0·342	S E.	29·798	77·3		(var.)
12	27·611	71·7	66	·676	0·075	S W.	29·697	75·7	0·258	S E.
13	27·591	70·7	67	·657		(var.)	29·598	86·3		(var.)
14	27·611	71·0	58	·598		N E.	29·605	82·0		W.
15	27·646	74·0	46	·576		E N E.	29·681	80·0		W.
16	27·708	68·0	65	·600		(var.)	29·826	75·0		S E.
17	27·738	66·0	58	·573		S E	29·856	72·0		S.
18	27·663	63·7	50	·477		N W.				S.
19	27·615	63·3	61	·504	0·043	N W.	29·624	72·0		S E.
20	27·720	60·3	59	·497		N.	29·788	71·7		N.
21	27·743	62·0	53	·491		S E.	29 842	70·7		N.
22	27·724	66·3	53	·491		(var.)	29·819	72·3		S E.
23	27 676	66·7	64	·554		S S E.	29 830	72 7		S E.
24	27·576	69·0	69	·623	0·665	W.	29·641	76·0	1·951	S E.
25	27·626	64 3	62	·448		W.	29·622	76·3		W.
26	27·675	63·3	80	·564	0·374	W.	29·710	74·0	0·325	W.
27	27·651	66·0	63	·531		(var.)	29·672	74·7		W.
28	27·642	60·3	61	·420	0·231	(var.)	29·683	71·0		(var.)
29	27·720	53·7	65	·320		N.	29·775	65·0		N W.
30	27·673	50·3	59	·423		W.	29·727	65·3		N W.
31	27·591	61·0	70	·495	0 035	W.	29·630	68·7		W.
Means	27·668	67 5	61	·586	3·713		29·726	75·8	5·304	

GETTYSBURG, Adams Co. 39° 49′ N. 77° 18′ W. Height 624 ft. Prof. M. JACOBS, Obs. — FLEMING, Centre Co. 40° 55′ N. 77° 53′ W. Ht. 780 ft. S. BRUGGER, Obs.

Aug't.	Gettysburg Bar. Mean.	Gettysburg Ther. Mean.	Gettysburg Rain.	Gettysburg Prevail'g winds.	Fleming Ther. Mean.	Fleming Rain.	Fleming Prevailing winds.
	Inch.	°	Inch.	Direc.	°	Inch.	Direc.
1	20·410	77·3		S S W.	72·3	0·310	(var.)
2	29·447	82·3	1 080	(var.)	72·7	0·150	S W.
3	29·465	77 3	0·015	(var.)	72·7	6·080	S W.
4	29·322	80·3	0·375	S S W.	78 3	0·212	W.
5	29·365	73 5	0·250	(var.)	73·3		(var)
6	29·464	72·0		S.	68 0		N W.
7	29·403	71·7		N W.	69·7		N W.
8	29·497	75 7		S W.	75·3		S E.
9	29·626	78·3		(var.)	76·0		S E.
10	29·428	78·0		S S W.	78·0		S W.
11	29·546	73·3		(var.)	75·3		(var.)
12	29·412	72·7	0·326	(var.)	71·0	0·560	(var.)
13	29·295	76·3		W.	71·0		N W.
14	29·346	76·7		N N E.	74·3		S E.
15	29·403	78·0		N E.	73·3		S W.
16	29·562	73·3		N E.	72·0		(var.)
17	29·526	68·0		N E.	67·7		S E.
18	29·433	66·3		S W.	66·0		(var.)
19	29·351	67·3		N E.	61·3	0·160	(var.)
20	29·510	68·7		N N E.	62·3		N W.
21	29·563	66·7		N E.	65 0		N W.
22	29·555	68·3		S.	67 7		(var.)
23	29·554	60·0		S S E.	69 0		S E.
24	20·374	70·3	1·330	(var)	70·3	1·660	(var.)
25	20·379	72·0		W.	68·0		N W.
26	29·459	71·7	0·265	(var.)	66·3	0·040	N W.
27	29·421	71·7	0·018	W.	67·0		N W.
28	29·425	66·3		N W.	65·0		(var.)
29	29·527	60·0		N.	54·7		N W.
30	29·465	60·0		W.	58·3		W.
31	29·363	66·3	0·025	S W.	63·0		S W.
Means	29·465	71·9	3·733		69·2	3·112	

JOURNAL

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DECEMBER, 1859.

CIVIL ENGINEERING.

Steam Engineering in 1859.*

(Continued from page 301.)

STEAM GENERATION.

In the introductory remarks, our readers will have noticed how carefully any exaggeration has been avoided in speaking of *possible* economics in generating and using steam; and we have taken this course, knowing there are many practical engineers of the present day who do not hesitate to speak of $1\frac{1}{2}$ and even 1 lb. of coal as sufficient to obtain an indicated H. P.; whether such statements will be borne out by any present or future improvements, time will prove. The reason we avoid what may be considered extreme views, is because we wish to stand on firm ground, and have all our statements supported by the general engineering experience of the country.

We propose, therefore, in the spirit of the introductory remarks, to allude simply to facts as they exist, and not to individuals, to attempt to separate the good from the bad, and to point out some of the legitimate improvements that can *always* be realized in the generation of steam, by faith in, and adherence to, the text with which we set out, —that "HEAT IS THE SOURCE OF ALL POWER IN STEAM."

Although the generation of steam or vapor of water has no necessary connexion with the machine in which the steam may be afterwards applied to produce motive power, yet it is generally the custom, in considering results, to mix the two together in such a way as to

*From the Lond. Artizan, June, 1859.

prevent the possibility of arriving at correct conclusions: the diameter of the cylinder is the dimension purchasers look to as the most important, whilst they receive, almost without comment, every variety and size of generator: the consequence of such a practice can be foreseen: the *amount of power* received for a given price varying to the extent of 30 and 40 per cent.

Elaborate and reliable experiments have been made to ascertain the quantity of heat necessary to evaporate a given weight of water, and we receive as ascertained facts the large amount of latent heat in steam, and the different quantities of fuel necessary to raise the temperature of a cubic foot of water from 32° to 212°, and to convert it from 212° into steam. We also take it for granted our readers are familiar with the expansive property of steam; if not, we cannot undertake to supply such elementary information.

In steam boilers we have two distinctive features—the fire-grate and the heating or absorbing surface—and they are so closely connected and mutually dependent on each other, that if the relative proportion between them be altered, there is an immediate alteration in the results.

It happens that inexpensive boilers in construction are not necessarily economical in performance; on the contrary, if a small boiler is required to produce a large supply of steam, the result is a considerable waste of fuel; this remark applies to all descriptions of boilers, for land or sea.

If all the heat developed in the combustion of 1 lb. of the best steam coal be utilized, it will evaporate from 14 lbs. to 15 lbs. of water at 212°. How near do we arrive at such a result in ordinary practice?—certainly not within 40 per cent. Ordinary land and marine boilers do not evaporate more than from 7 lbs. to $8\frac{1}{2}$ lbs. of water at 212° per 1 lb. of fuel; in fact, it has been stated on good authority that the average duty of land boilers in the Lancashire districts does not exceed from 6 lbs. to 7 lbs. of water at 212° evaporated by 1 lb. of coal. There are instances of 10 lbs., 11 lbs., and $11\frac{1}{2}$ lbs. of water at 212° being evaporated by 1 lb. of the best fuel; and if the late Newcastle experiments can be relied on, nearly 13 lbs. was evaporated; but this latter duty in an ordinary marine boiler, although with fresh water, is so far above what is realized in general practice, and so *very near* the theoretical value, that we cannot at present admit it in our calculations; it may, however, be conceded that fully 11 lbs. of water at 212° can be evaporated by 1 lb. of good steam coal,—an improvement of more than 30 per cent. on the general practice of the present day.

In generating steam there are two chief sources of waste—radiation, and the heated gases allowed to escape through the chimney. The first can be partly removed by clothing the boiler with non-conducting material; the second is the most important and the most difficult to contend with.

In locomotives the temperature of the escaping gases is upwards of 1000°; in land boilers, from 400° to 600°; and in marine boilers, from 500° to 900°; in each case depending to a great extent upon the rela-

tive proportion between the fire-grate and the absorbing surface, or, more correctly, between the amount of fuel consumed in a given time and the absorbing surface. And this brings us to the real practical difficulty of combining economy of fuel with the development of great evaporating power in a boiler of a given size and weight.

The amount of evaporation in a given time in steam boilers of the same type, is proportional to some extent to the difference between the temperatures of the escaping heated gases and the water to be evaporated with a given absorbing surface: the higher the temperature of the said gases the greater the evaporation in a given time, and the greater the amount of fuel required to evaporate a given quantity of water. On the other hand, the nearer the temperature of the escaping gases approximates to the temperature of the water to be evaporated, the less the evaporation in a given time, and the less the amount of fuel required to evaporate a given quantity of water.

In the above statements it is assumed in each case the boilers are of similar construction and worked under similar circumstances, the only difference being in the ratios of the absorbing surface to the amount of fuel consumed in any given time: the truth of the above is seen every day. In one case (we state actual instances,) there is a marine boiler having 1600 feet of absorbing surface, and 80 feet of fire-grate, or a ratio of 20 to 1, the combustion is at the rate of 24 lbs. per sq. foot of fire-grate per hour, the escaping gases have a temperature of upwards of 800°, $6\frac{1}{4}$ lbs. of water is raised from 100° to 260°, and evaporated by 1 lb. of fuel, and 190 cubic feet of water are evaporated per hour, or 1 cubic foot to $8\frac{1}{2}$ sq. feet of absorbing surface.

In another instance, we have a marine boiler of similar construction and proportions, except in the ratio of fire-grate to absorbing surface, the latter being, 1200 sq. ft., and the former 40 sq. ft., or a ratio of 30 to 1. The combustion is at the rate of 16 lbs. per sq. ft. of fire-grate per hour; the escaping gases have a temperature of 450°; $8\frac{1}{2}$ lbs. of water are raised from 100° to 270° and evaporated by 1 lb. of fuel, and 87 cubic ft. of water are evaporated per hour, or 1 cubic ft. to $13\frac{3}{4}$ sq. ft. of heating surface.

These boilers are working under like circumstances, and, leaving out decimals, the figures given are substantially correct, and fully illustrate the connexion, previously stated to exist, between the temperature of the waste heat and the duty and economy realized.

If engineers had simply to generate steam with the least possible expenditure of fuel, regardless of time, and the cost, weight, and capacity of the generator, the problem could be solved with comparative ease, but the case is totally different; a certain weight of steam has to be produced in the least possible time with the least possible cost, weight, and capacity of the generator, and, above all, with the least possible expenditure of fuel—regard being had also to durability and facilities for repair. Here we have the most conflicting conditions, and it cannot be matter of surprise if mistakes have been, and are being made, it being only necessary that one element be over-valued or another be under-valued, to insure an unsatisfactory result. One manu-

facturing engineer swears by his fire-grate, another by his heating surface, and another by his proportion or form of flues; it matters not which is the favorite view (one may be adopted with less injury to the purchaser than another); nothing short of an impartial consideration of each and *all* of the requirements in generating steam can meet the difficulties of the case.

If such impartial consideration was the general rule, there would be no occasion for the present remarks.

The history of the locomotive boiler clearly shows how little previous design has had to do with its present efficiency; the necessity of using high pressure steam, and the difficulty of condensing, led the way to the blast; and it must be admitted that, of all kinds of boilers, the locomotive is the most scientific and the most economical, if allowance be made for the peculiar requirements connected with its use.

Notwithstanding the temperature of the smoke-box is often 1000°, with a combustion of from 60 to 120 lbs. of fuel per square foot of fire-grate per hour, a larger amount of water is evaporated by a given weight of fuel than in the majority of land or marine boilers. The rapid combustion is more perfect—almost every portion of the boiler is protected by non-conducting materials—less than 7 ft. of heating surface is sufficient to evaporate a cubic foot of water—and 1 lb. of Welch coal will evaporate $8\frac{1}{2}$ to 9 lbs. of water: nevertheless, there is much unnecessary waste of fuel in the high temperature of the escaping gases (although they are not, *comparatively*, so high when the temperature in the furnace is considered), and in supplying the feed-water at a low temperature. With the introduction of coal as fuel, modifications may be required in the furnace and tubes; and there is much reason to believe, from comparative experiments, that *crowded* tubes do not allow the steam to escape to the steam space as quickly as it is generated.

We may confidently look to a considerable increase of economy and efficiency in the locomotive boiler, even though now for weight, space, cost, and economy of fuel, it must be placed at the top of the list, and certainly deserves the least criticism.

The duty and economy of steam boilers are mainly dependent on the rate of combustion, the ratio between the heating surface and the fire-grate, and the ratio between the heating surface and the consumption of fuel per hour, thus:—

Rate of Combustion.

Cornish boilers burn per square foot of fire-grate,	4 lbs.
Ordinary land boilers, . . .	12 "
Marine boilers, . . .	18 "
Locomotive boilers, . . .	100 "

Ratio between Heating Surface and Fire-grate.

Ordinary land boilers, . . .	12 to 1.
Marine boilers, . . .	27 to 1.
Cornish boilers, ...	36 to 1.
Locomotive boilers, . . .	75 to 1.

RATIO OF HEATING SURFACE TO RATE OF COMBUSTION.

Cornish boilers,	9·0 to 1.
Marine boilers,	1·5 to 1.
Ordinary land boilers,	1·0 to 1.
Locomotive boilers,	0·75 to 1.

The preceding figures are only approximate, but they represent the particular features of each class, and if we were to tabulate them according to the *economy* generally realized, the Cornish boiler would stand first, the marine second, and the common land boiler third; for obvious reasons, the locomotive boiler cannot be fairly classed with the other three.

If we take as a standard the *rate of evaporation* for a given quantity of heating surface, we must place the common land boiler first, the marine boiler second, and the Cornish boiler third; and here again the locomotive boiler must be omitted as an exceptional construction.

In such general remarks and statements as the preceding, it is not necessary that they should represent the experience of all our readers—they are based on actual practice, and suffice to illustrate the subject under discussion, and point out the connexion always existing between sound principles and successful practical engineering.

It is assumed, as generally acknowledged, that from 30 to 60 per cent. of fuel is wasted in generating steam, and that a considerable amount of this waste ought to be, and can be, avoided; and although we do not dictate the exact means for accomplishing this, we can easily trace out, in the majority of cases, the direction of the improvement required.

Boilers made and used in districts where fuel is cheaply obtained have never been remarkable for their economical performances, nor are the engineers in those districts famed for great anxiety to introduce improvements for economizing fuel; it cannot be expected, and we are not surprised to know that land boilers in coal districts only evaporate 6 lbs. of water at 212° by 1 lb. of fuel.

With wagon or plain cylindrical boilers, that form such a large proportion of those now in use on land, economy of fuel is simply a question of size to produce a given weight of steam, it becomes almost entirely a question of capital; an increased ratio between the heating surface and the fire-grate is in this case the desideratum; the furnace flues and chimney being well proportioned, and every effort made to check radiation.

In the Cornish boiler, where the furnace is *within* the inside tube or tubes, that temperature in combustion which is so essential to its perfection is not easily obtained; hence the difficulty that arises in attempts to consume the smoke in such furnaces; an increase of duty and economy would ensue from placing the furnace *under* the boiler, and returning the heated gases through two smaller tubes—a plan that has been often tried with universal success; it allows ample space in the furnace, insures perfect combustion, and has also other mechanical advantages.

In other descriptions of land boilers, where additional heating surface is introduced within the main shell, if well proportioned, they are

generally more economical than the Cornish boilers with the same ratio of heating surface to fire-grate, and with the same rate of combustion.

There can be no doubt that, for land purposes, a boiler with internal flues, capacious furnace, a greatly increased ratio between the heating surface and the fire-grate, and a rate of combustion above that in general practice, is the cheapest, the most effective, and the most economical.

There can be—indeed there is—no difficulty with such boilers in realizing an increased economy to the extent of 30 per cent., and in obtaining a greater effect in a given time from a ton weight of boiler.

We must defer to next month our investigation of the present state and future prospects of steam generation in marine boilers—the most important branch of our subject. If there are reasons why we should economize fuel on shore, how much stronger do they become when it is a question of freight as well as of fuel saved.

In addition to the purely economical value of steam boilers, we shall hereafter have to consider their mechanical construction, especially as affected by the introduction of steam of high pressure.

In concluding these remarks, we would impress on our readers that our only wish is to direct attention generally to present defects in the Steam Engineering of 1859, and to point out to young engineers those paths of improvement where their energies and talents will be productive of real benefit to their profession, and to the world at large.

(To be Continued.)

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*Under Sunk Foundations.** By C. I. Spencer, Resident Engineer of Chunar Division, East India Railway.

The following remarks on the subject of well-sinking in bridge foundations embody the experience gained in sinking the foundation wells of a bridge over the Jurgoonullah, a hill stream which runs into the Ganges a few miles below Chunar.

Such knowledge being derived from one job is necessarily partial and limited, and is only offered as a contribution towards the general stock of information wanted on a very interesting subject; and I shall be thankful to any one engaged on similar works who will correct, from more complete information, any erroneous conclusions I may have come to, or raise a discussion on any doubtful point.

The Jurgoo well-sinking, which was commenced in October, 1857, has just been brought to a successful termination, and what few mistakes were made at starting in points on which we had not the light of experience to guide us, have not involved any serious ill consequences, and are now fruitful of instruction.

In deciding upon the use of under sunk foundations in preference to piles, coffer dams, or any other expedient, it is necessary to take into consideration the form and material of the bed of the river to be bridged, the floods to which it is subject, and their tendency to scour to any given depth.

In these particulars the Jurgoonullah is so circumstanced, as to ren-

* From the Lond. Civ. Eng. and Arch. Journal, Sept., 1859.

der it unsafe or difficult to use any other kind of foundation than the one adopted. The bed at the point bridged, consists almost entirely of sand, gravel, and other loose drift material, to a depth of about 20 feet, below which occurs a stratum of pure white sand of unknown thickness, which extends under the strong kunkury clay at the banks of the nullah, and has evidently never been disturbed by the action of the stream.

The stream itself is a mere hill-torrent, rising above 20 feet in two or three hours and falling again as rapidly; in the dry weather it does not rise above its bed, but stands in pools in the sand. Besides the hill floods, the nullah is subject to overflow from the backwater of the Ganges, and the alternating and sometimes combined action of these floods gives rise to alternate scourings and fillings of a kind very difficult to foresee or provide for.

The only certain principle therefore upon which it was possible to proceed was to assume that what the water had done it would do again, that the scour would reach on some future occasion the depth it had reached before, and having ascertained this limit, to sink the wells to what might be considered a safe distance below it, and there leave them in the white sand which there appeared no hope of getting to the bottom of.

In such a situation piles would have been useless, the stuff would have been washed out from between them, and the bridge been left standing on the naked sticks; sheet piling could never have been driven deep enough to defend them from the scour, and to have sunk coffer dams 30 feet into the bed, dredged out the stuff, and filled the bottom with concrete, might have been a safe plan, but would certainly have been a tedious and expensive one.

Having then once determined on the use of wells, the next thing was to find out the proper dimensions and arrangement, as well as the best form of curb and mode of attaching it to the masonry. In all these particulars, the one great object to be attained is to make a well which shall *sink*, for if by any accident or defect in design or construction, one of the wells should stick half way and obstinately refuse to budge an inch, a contingency which sometimes happens, it is next to impossible to get it out again, and the engineer may be placed in the unpleasant position of having to alter his design and begin foundations in a new place.

Before considering the causes which tend to impede the descent of wells, I shall describe the different modes adopted for sinking them.

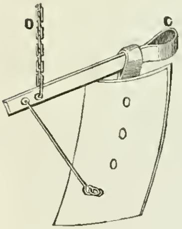
In every case the first step is to lay the curb on the surface, as low down as possible, and build the wall to a height above it, equal to somewhat less than its own diameter; the sand and stuff is then cleaned out from the interior, and leaves a hollow into which the well sinks. For the first few feet the men can stand in the water and lift the sand out easily enough, but as the water gets deeper, it becomes necessary either to get rid of the water or to contrive some way of working under water.

The first plan, viz: getting out the water, is, when feasible, by far the most speedy and satisfactory, and it may sometimes be advisable

even to go to the expense of a steam engine to work the wells dry. Where this cannot be done, or where the quantity of water is not so great as to require it, the pumping may be done more awkwardly, but more cheaply, by means of buckets and pulleys worked by coolies. A large amount of the Jurgoo well-sinking was done by these means: two or three leathern buckets or rather bags (*mhotes*), each pulled by eight or ten coolies, were let down each well, and with European superintendence and energetic driving, it was found possible in most cases to lower the water in three or four hours sufficiently for the men to stand in it.

2. When the water cannot be got low enough, or even while it is in process of lowering, the stuff may be got out by means of divers, who go down with a small iron plate, with which they shovel the sand into a basket, which when full is drawn up by a couple of women. The divers stay about 15 seconds under water, and will often fill a basket at one dive, but they soon get tired, and it was found necessary to have four relays of them every day, and to pay each of them four annas per diem, or about three times the pay of an ordinary coolie.

3. The jham is used in cases where the water cannot be lowered and is too deep for divers. It consists of a plate of iron about 2 feet square; at the upper end is a collar C, into which is inserted the end of a pole which is about 4 or 5 feet longer than the depth of the well:



the jham with the pole fixed is dropped with some force on to the bottom of the well, and the pole is moved about by the men above, so as to work the edge of the iron as deep as possible into the soil. The chain O is then drawn up by means of a windlass, the collar C disengages itself from the spindle end of the pole, the lower end of the shovel is lifted up, and the jham plate hangs like a scale pan, with a certain, or rather a very uncertain, quantity of stuff in it. This has to be lifted slowly and carefully, so that the water may not wash it away. When it reaches the mouth of the well the contents are drawn out, the pole fixed, and the whole contrivance dropped once more to the bottom.

The jham works sometimes very well in sand and loose material, and I have seen them at the Jumna coming up with about a cubic foot of stuff on them; but it is at best a capricious thing, and often comes up empty or with the merest spoonful of earth on it, especially when used to get up hard clay or kunkury sand. I do not know who was the inventor of this singular instrument, but he must have been in India a long time, and have got the idea of a codalee irretrievably fixed in his mind. It is, however, as far as I know, the best instrument that has yet been invented for the purpose. I have seen dredges tried, but never heard of one being applied successfully. There was one tried at the Jurgoo, but the buckets had a trick of getting upside down, or hind part before, or any way but the right one. They have,

I believe, been since tried at the Jumna, and it would be interesting to know how far they have succeeded. The one used at the Jurgoo consisted of a set of small scoops or buckets fastened at intervals of about 2 feet along a couple of ordinary chains, which passed round a couple of rollers at top and bottom of a square frame inside the well; one of these chains was constantly gaining on the other, and the buckets getting tilted up at one side. To obviate this I would propose making each pair of links the full length of the distance between two successive buckets, and making the roller of a polygonal form, each side being equal to the length of one link.

I do not, however, think that a dredge is the thing required for well-sinking. It is too large and too heavy, and takes too much time in fixing and lengthening, and is too expensive in proportion to the total cost of sinking. What is wanted is some machine that can be worked like a jham at the end of a pole, but which will be more certain in its action and less liable to come up empty—something which can be lifted out of one well into another easily and readily without carpenters, and not keep all your coolies waiting for more than half an hour at most.

I submit the question to the ingenious among your correspondents: if any of them can solve it in a good, practical, practicable form, he will supply a great desideratum in Indian public works.

Such are the chief methods which have been employed to sink the Jurgoo wells.

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*Mann's Patent Safety Apparatus for Steam Boilers.**

The accompanying wood cut exhibits a front elevation of a very simple and ingenious apparatus invented by Mr. Mann, the engineer of the City of London Gas Works.

The contrivance is intended to record the proper attention or neglect to the testing the ordinary water and steam-cocks of boilers, and accurate register of the steam-pressure within the boiler may be secured by the same instrument. It is applied very readily to any steam-boiler, and in any convenient position.

The following is a description of the apparatus:—

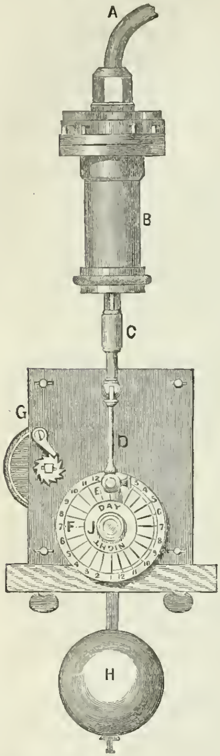
The pipe A admits steam to a spring piston in the cylinder B, which descends in proportion to the pressure of the steam in the boiler; the arm C is fixed to the end of the piston-rod, and is carried downwards with it; the nature of the arrangement will have an *upward motion*, hence, as the pressure of the steam increases, the pencil E, in the pencil bar O, will be drawn up to one of the circular lines of pressure on the diagram paper or card.

E is the pencil, which can be removed in a moment, if required, by simply throwing up the lever, in which condition it will remain, until the pencil is replaced, when it is again brought down and left to keep the pencil up to its work, by a gentle pressure received from the spring at its upper end.

The eight day clock, of which the barrel, G, is seen, carries round

* From the Lond. Artizan, August, 1859.

once in 24 hours, a metal disc, to which is fixed by the thumb-screw, J, the paper or card disc having thereon circles corresponding to the steam pressure from zero to 40 lbs. (or higher if required), and radial lines equal to the twenty-four hours of the day.



The apparatus works in the following manner:—Upon the gauge-cocks being tried at the intervals of time during the day or night for which the circular card has been divided, that shown in the accompanying diagram having divisions of one hour, although there may, in practice, be two, four, or more divisions in the hour. The piston is caused by the pressure of steam above it (admitted from a suitable pipe connected with the gauge-cocks), to descend, and carry the pencil downward toward the centre of the card, making a radial mark thereon to an extent corresponding with the change of pressure—the time of opening the cock being recorded by the rotation of the card by the clock-work, so that should the attendant not be present and open the cocks at the proper time, the division or line upon which the mark should have been made will have passed the point of the pencil and the line of its course.

This apparatus is both simple and ingenious. It has been used most successfully at the City Gas Works for many months past, and it deserves to be better known and more generally adopted.

We are glad to perceive attention is being called to the want of such apparatus, as will be seen by the following extract from the report of Mr. Longridge, of Manchester:—

"In reference to the boilers which sustained injury, in consequence of deficiency of water, it is mentioned that in one case the explosionwas caused by fracture of the blow-off pipe which, during the night, allowed the water to escape unobserved by the watchman, who continued firing after the boiler was empty. In the other two cases the feed-valves appear not to have been tight, and, on preparing to start in the morning, the water in the boilers was driven back by the increasing pressure of the steam, and the furnace crowns much injured in consequence. Though these boilers were provided with glass tube-gauges and floats, these appear to have received no attention at the time, thus pointing out the necessity of employing other means of safety."

AMERICAN PATENTS.

List of American Patents which issued from September 13, to September 27, 1859, (inclusive,) with Exemplifications.

SEPTEMBER 13.

97. Lamp Chimneys; Elias J. Hale, Foxcroft, Maine.

Claim—Contracting the chimney above the flame, and admitting at or near the same point a current of air, in the manner set forth.

98. Exhaust Pipe for Steam Engines; Robert Hale, Roxbury, Massachusetts.

Claim—An exhaust pipe, constructed as described, and having an opening and a steam pipe, in combination with a lip, operating in the manner set forth.

99. Excavator; William Hamilton, St. Catharine, Missouri.

Claim—1st, In combination with an excavator frame, constructed as described, having the side timbers braced in front only, I claim four wheels, when arranged in relation to the said frame, so that a common cart may either be backed between the hind wheels, or pushed over said wheels and frame, under the excavator, when the same is hoisted to be discharged. 2d. The combination of an excavator with a frame, having the rear ends of each of the side timbers bifurcated for the reception of the wheel, the same being arranged to turn on a pin or journal, extending transversely through the two forks. 3d, The peculiar arrangement of hanging the excavator to the frame by means of arms, the same being so pivoted at the ends respectively to the excavator and side timbers, as that they shall be exposed to a tensile strain in the draft line, or thereabout, during the excavating operation of the machine.

100. Barrel Syringes; Stephen P. Hart, Boston, Massachusetts.

Claim—The spring, as applied to the syringe, operating in the manner set forth.

101. Churn; Malachi B. Hassler, Columbia City, Indiana.

Claim—The arrangement of the hinged curved leaf, in combination with the wings, arranged as described.

102. Construction of Segmental Circular Saws; R. K. Hawley, Baltimore, Maryland.

Claim—A segmental veneer saw, the blades of which are formed, hung, and clamped, in the manner described.

103. Grinding the Teeth of Mowers and Reapers; David Hinman, Berea, Ohio.

Claim—The circular grooves on the faces of the grindstone in connexion with the standards and holder, arranged and operating in the manner specified.

104. Mangle; W. W. Hollman, Eddyville, Kentucky.

Claim—The combination of the levers with one of the rolls and balancing lever, as set forth.

105. Mode of Manufacturing Telegraph Cables; W. H. Horstman, Brooklyn, New York.

Claim—Constructing the cable by the apparatus, consisting of the reservoir, wrapping apparatus, &c., or their equivalents, as specified. Also, the final reservoir for coating a telegraphic cable after it has passed all the other apparatus, and before it has entered the water or ground, constructed and applied as specified. Also, the manufacturing of the cable, in the manner described, at the time it is laid, so as to perfect it and at once launch it into the place where it is to remain, whereby I avoid all the chances for injury and imperfections arising therefrom, growing out of stowing and handling the cable after it has been made, as heretofore has been done.

106. Harvesting Machines; A. H. Inskeep, Middleburg, Ohio.

Claim—1st, The arrangement of the revolving, spiral, cone-shaped cutter or gatherer with the base of the cone in front, to gather up and draw the grain back to either stationary or reciprocating cutters, as described. 2d, The combination of the spirally-formed gatherer or cutter, arranged as described, with the divider, guards, and stationary cutters.

107. Cultivators; W. D. Johnson, Raleigh, North Carolina.

Claim—The bars, curved so as to form handles at one end, and having horizontal oblique positions to form the body of the frame, the draft bar, and guide or retaining bar, the front ends of the bars being connected or secured together by the collar or loop, in combination with the double scraper.

108. Seeding Machines; W. D. Johnson, Raleigh, North Carolina.

Claim—The arrangement of two distributing slides with the projections on the wheels, and two or more compartments in the hopper, inclined tube, inclined draft bar, and adjustable roller standard.

109. Boilers for Making Paper Pulp from Wood; Morris L. Keen, Rogers' Ford, Pennsylvania.

Claim—A boiler for boiling, under pressure, wood and ligneous materials for making paper pulp, constructed with an expansion chamber, stirrers, and discharge valve or cock, arranged in the manner stated.

110. Cultivators; Asa M. Keith, Kosciusko, Mississippi.

Claim—The arrangement of the double scraper, the hoe drum, and the hillers or coverers, in their relation to each other and to the parts of the frame to which they are attached, as set forth.

111. Movable Tops for Carriages; John C. Kimball, New Haven, Connecticut.

Claim—So constructing the standards or supports of a standing carriage top, and attaching them by means of screws, that the top and standards or supports may be readily removed, when the whole is constructed and connected substantially as described. Also, the combination of the standards with the body, when the standards are secured, being screwed into the upper ends of the studs, and the whole is constructed as described.

112. Locomotive Lamps; Nelson J. Knapp, Chicago, Illinois.

Claim—The combination of the ellipsoidal and paraboloidal reflectors and burner, arranged as set forth.

13. Machine for Arranging Pegs; Jesse Ladd, Holderness, New Hampshire.

Claim—A machine or combination, consisting of the following devices, or their mechanical equivalents, viz:—1, The grooved cylinder, furnished with a hopper or other proper means of supplying it with pegs. 2. The guiding receiver. 3, One or more advancers, and the operative mechanism thereof. 4, A device or mechanism for discharging from the guiding receiver the refuse pegs. 5, The springs or devices for preventing the discharge of the pegs from the guiding receiver, when they may be disposed therein with their butts in advance of their points. 6, The receiving spout. 7, The peg-carrier; and 8, Mechanism for advancing the pegs through the said carrier. Also, in combination with the said machine, or its hopper and grooved cylinder, an agitator, or means of shaking or agitating the mass of pegs in the hopper, or its conductor. Also, in combination with the said machine or its receiving spout, the serrated bar, operated as described, or mechanism for insuring the descent of the pegs within the receiving spout. Also, in combination with the said machine or with the receiving spout and peg-carrier thereof, the device or part, U, made to operate in manner and by means specified. Also, in combination with the said machine or the receiving spout thereof, the door and its operative mechanism, whereby the surplus pegs may be discharged from the spout after it may become sufficiently supplied with pegs. Also, in combination with the said machine or its spout, the finger, or equivalent, to be operated in manner and by means as described.

114. Board Measurer; Augustus Lafever, Battlecreek, Michigan.

Claim—1st, The employment or use of the cone gears and sliding pinions, in connexion with an endless toothed or serrated chain fitted within a suitable case, arranged with gearing and indexes, and with or without the arm and lever. 2d. The arrangement of the yielding frames with the pinion and cone gear, respectively attached to levers and racks.

115. Dumping Cart; John S. Lash, Carlisle, Pennsylvania.

Claim—The employment or use of the curved or segment rack attached to the rod and provided with the ledge, the pinion and hooks, arranged as set forth. Also, the rod provided with the spring, and connected to the sliding or pressure bar provided with the arm, the above parts being applied to the cart, and arranged to operate as set forth.

116. Corn Planters; William Lees, Germantown, Ohio.

Claim—The cylinders, in combination with the hoppers with reference to the feed bar, arranged to operate as set forth.

117. Piano-fortes; Ferdinand C. Lighte, City of New York.

Claim—1st, The crystal reverberator of glass, or other material, applied below or at the back of the sound-board, in combination with openings therein, as described. 2d, The insulators, applied between the iron frame or plate, and the rest plank and wooden blocking of the instrument, in such manner that the said frame or plate will bear upon the plank and blocking only at few points, as described.

118. Tobacco Presses; George Lindsey and Wm. Cameron, Petersburgh, Virginia.

Claim—A portable hydraulic jack, or other powerful press, so constructed as to be readily applied to an ordinary or to a series of ordinary screw presses, for the purpose described, and adjustable as to height on the truck on which it rests, in combination with the railroad track, E, at right angles with the track, D, when said press is used for increasing the pressure of the screw press and converting it into a retaining press, as described.

119. Lock and Detector; John H. Lyon, City of New York.

Claim—Combining with a padlock, or any lock provided with a shackle, a supplemental shackle, arranged with a lead or soft metal tube, so as to be temporarily secured thereby to the lock case, and admitting of being released only by the severing of the said tube, which thereby serves as a detector. Also, forming the lock case of two parts, with a division plate between, whereby the construction of the lock is rendered extremely simple, and the invention enabled to be carried out or produced at a moderate cost.

120. Steering Apparatus for Barges in Rivers; Murdock Lytle, Alleghany, Pennsylvania.

Claim—The application of a wheel to the bow of a barge, so that said wheel shall revolve at right angles to the direction of the barge, in combination with an apparatus for operating said wheel by the power of the propelling boat.

121. Seeding Machines: Jacob Maize, Wooster, Ohio.

Claim—The adjustable cultivators provided with the arms, guides, and the adjustable jointed harrow, arranged as described, and acting conjointly with the seeding apparatus, in the manner set forth.

122. Dovetailing Machine; W. A. McDonald, Mott Haven, New York.

Claim—1st, The employment or use of spiral saw-cutters attached to the rotating heads connected by gearing. 2d, In combination with the cutters, the adjustable platform. 3d, The combination of the cutters, platform, and gauge, operated by the screw, for the purpose set forth.

123. Cultivators; Edmund and Benjamin Miller, Rising Sun, Indiana.

Claim—The combined arrangement of the guard, elevated wing, curved horizontally in two directions, adjusting shank, and bracket, operating in connexion with a shovel plough, in the manner set forth.

124. Shingle Machine; Henry Miller, Grafton, Virginia.

Claim—The manner of tilting the bed, by means of the adjustable wheel on shaft, actuated by the ratchet also on said shaft, the pawl on the framing, spring attached to the carriage, and spring attached to the framing, and acting on the bed, the whole being arranged as set forth. Also, the arrangement of the bed and rods attached to the framing, as shown, to admit of the vertical adjustment of the bed, for the purpose of graduating the thickness of the shingles.

125 Cotton Scrapers; Jonathan H. Mitchell, Germantown, Tennessee.

Claim—1st, The combination and arrangement of the beam, chair, mould-board, and share, operating, as set forth. 2d, The adjustable and changeable share, arranged and operating as set forth.

126. Corn Planters; William Morrison, Carlisle, Pennsylvania.

Claim—A corn planter, constructed with the mould-boards, adjustable cutters or coverers, hopper, slides, and clearers.

127. Ploughs; William O'Neill, Pine Level, Alabama.

Claim—The lapping land-sides of the ploughs and the bar, attached to the beam, as specified, in combination with the bolts, nuts, and braces described, whereby they may be formed at pleasure into a double or hill-side plough.

128. PLOUGHS; William O'Neill, Pine Level, Alabama.

Claim—The arrangement of the adjustable mould-boards, attached to the share by bolts, and constructed as described, with braces, stock, and share, and point.

129. LAMPS; George T. Parkhurst, Baltimore, Maryland.

Claim—The flattened air tubes, bent at right or other convenient angles, with a slit or opening at the outer angles, in combination with flat wick tubes, and the combination of the above parts with the cap or dome, made or operating as described.

130. CARRIAGE SPRINGS; Stephen B. Peet, City of New York.

Claim—A compound spring, composed of a combination of an elliptic leaf or leaves and a volute coil.

131. SAUSAGE-STUFFER; John G. Perry, Kingston, Rhode Island.

Claim—Combining the cylinders, having a spiral cavity or cavities, with the follower, as described.

132. HORSE RAKES; Orris Pier, Ludlow, Vermont.

Claim—The combination of the adjustable bar, I, lever, bar, E, rods, rake, strap, and seat, as described.

133. BOILERS AND STEAMERS; Daniel R. Prindle, Bethany, New York.

Claim—The so turning or forming the flanch of the upper section that it will contain water to prevent the fire from burning the packing beneath the flanches.

134. SEEDING MACHINES; S. G. Randall, New Braintree, Massachusetts.

Claim—The arrangement and combination of the series of plate wheels, seed boxes, and horizontal bar, so that as the bar is drawn along, the plate wheels shall assume an oblique position.

135. SKIVING MACHINES; J. A. Safford, Winchester, Mass., and John W. Chase, North Weare, N. H.

Claim—1st, Hanging the gauge roll in vibrating frames, in combination with the spring and retaining spring-catch, and adjustable stops, arranged as specified. 2d, The over-lapping knife, in combination with the adjustable spring apron, arranged as specified.

136. CARRIAGE-TOPS; Francis C. Shatler, Brooklyn, New York.

Claim—The arrangement and combination with the curtains, of the hooks, guides, and supporters, so that the curtains may be kept stretched, and be readily lowered or raised and secured overhead, within the carriage at any desired point.

137. SPIRIT LEVEL; Thaddeus S. Scoville, Rochester, New York.

Claim—Employing a single transparent cell or cistern of spirits, or other fluids, in combination with the scale and rectangular stock, in such a manner that the surface line of the liquid shall indicate both the horizontal and perpendicular, with the intermediate degrees.

138. SEEDING MACHINES; Harvey Sloan, Franklin, Indiana.

Claim—1st, The arrangement of shanks, drag-bars, levers, bar, rest, and support, combined and operating as specified. 2d, In connexion with the subject of the first claim, the arrangement of rollers, seed boxes, and slides, constructed as specified.

139. RAILROAD CAR SEATS; C. A. Smith, Piermont, New York.

Claim—1st, The arrangement of the back and bottom of a car seat, so that when the seat is adjusted to an inclined position both parts to move together on the same pivot on which the back moves, independent of the bottom, when the seat is reversed. 2d, The spring catch, notched arc, bottom, and back, arranged as described.

140. COTTON SEED PLANTERS; P. M. Smith and T. T. Collier, Lavernia, Texas.

Claim—The arrangement and combination of the wheels, axle, crank, pulley, slide, agitator, fender-bar, plough-share, and scraper, as described.

141 THIMBLE; James C. R. Steirly, Brooklyn, New York.

Claim—The combination of the thimble and cutter, in the manner set forth.

142. COOKING STOVES; David Stuart, Philadelphia, Pennsylvania.

Claim—Combining with the hollow cross-piece the distributor, arranged as set forth.

143. FOLDING CHAIR; J. H. Swan, City of New York.

Claim—1st, The arrangement of the back, seat, and arms, so that the back and seat, when occupied, will be nearly counterpoised, and the arms moved with the seat and back. 2d, In combination with the back, seat, and arms, the curved legs, arranged so as to admit of being completely folded.

144. CHURN; James Taylor, Rushville, Illinois.

Claim—The peculiar construction and arrangement of perforated brakes and auxiliary reflectors, in combination with a dasher, having its blades flattened out gradually from near the shaft to their ends.

145. MACHINERY FOR FORMING HAT BODIES; James S. Taylor, Danbury, Connecticut.

Claim—The combination of the two perforated cones and exhaust, with one picker and feed arrangement, so arranged that the current of impelled fur is alternately shifted from the tip of one cone across on to the tip of the other, in such a manner as to give the required proportions in forming a perfect hat body.

146. WASHING MACHINE; George W. Tolhurst, Liverpool, Ohio.

Claim—The inside bottom box constructed air-tight, so that when the pressure of the upper rubber is removed it will float, and expose the clothes to be handled.

147. SEEDING MACHINES; M. L. Tourtelett, Neshonoc, Wisconsin.

Claim—The combination and arrangement of the levers, connected by the traverse rod, the cam, and the slides, for joint operation.

148. HYGROMETER; Louis S. Ullmann, Nashville, Tennessee.

Claim—The combination of the capsule and naturally spiral tail-like appendage of either of the plants specified, with an index or dial, or their equivalents, substantially as described, to constitute a hygrometer.

149. MACHINE FOR WEIGHING GRAIN, &c.; John Van Horne, Magnolia, Illinois.

Claim—Weighing, by means of a round ball or self-acting weigher, operating in a concave beam, or

balance and blocks, and spiral springs, working in the bottom of the beam by means of the grooves, so as to weigh different weights or drafts, H, and board, combined, for the purposes set forth.

150. MACHINES FOR RAKING AND LOADING HAY; Thomas J. Wallace, Cameron, Illinois.

Claim—1st, A hay-raker and loader, arranged and combined together as described. 2d, The combination of the inclined part, A, with its pivot, with the part, A, of the main frame and slot, as set forth.

151. CARPENTERS' RULE; Hamlin Whitmore and David M. Smith, Springfield, Vermont.

Claim—The spiral springs applied to the pintle of the joint, in combination with the elastic bearings of the plates provided with notches and projections, as set forth.

152. CORN PLANTERS; Charles Whitaker, Davenport, Iowa.

Claim—The arrangement of the seed boxes or receptacles, slides, stationary plates, and movable plate, with the arms and weights attached.

153. GRATES; J. S. Williams, St. Louis, Missouri.

Claim—The combination of the stove grate having register plates and valves which admit unheated air from the room at all times, through the bottom of said plates, but control the flow of heated air into the room with the ordinary fire-place, when the latter is separated from the flue above by a simple fire-board.

154. PLOUGHS; W. B. Williams, Warrenton, North Carolina.

Claim—1st, The combination of screw-bolts, nut in beam, standard, cuff, and slotted brace, to regulate the depth of ploughing. 2d, And in combination with the above, the curved arm for collecting weeds.

155. PLOUGHS; W. B. Williams, Warrenton, North Carolina.

Claim—The combination of standards, plate, and oblique wings, with share.

156. CONVERTING ROTARY INTO RECIPROCATING RECTILINEAR MOTION; Albert Broughton, Malone, New York.

Claim—The combination of the divided journal-box, containing two bearings, and closed by springs, G G, and the spring, I, or toothed plate, with the vibrating pinion shaft.

157. COVER FOR STOVE PLATES; J. H. Gould, Alliance, Assignor to self and E. A. Hartshorn, Mount Union, Ohio.

Claim—The self-erecting handle, in combination with weights, arranged essentially as set forth.

158. BRICK MACHINES; James A. Hamer, Reading, and Norris Maris, Kimberton, Pennsylvania.

Claim—1st, The combination of the blades and rods with the valves and spiral, arranged as set forth. 2d, The combination of the adjustable cover with spiral and trough, for the purpose of relieving or increasing the pressure upon the clay in the moulds. 3d, The combination of the hinged smoothing-piece with the hinged vertically reciprocating piece, as set forth. 4th, Providing the hinged smoothing-piece with the slot and tube, as set forth.

159. CALENDAR CLOCKS; S. P. La Due, Assignor to Thomas S. La Due, Rockford, Iowa.

Claim—1st, The arrangement and combination of the wheels and the ring, the faces of which are marked with the proper figures and letters, so that they indicate the seconds, the minutes, the hours, and the days of the week and month. 2d, Arranging the wheel in such a manner that it serves the double purpose of actuating the bell-hammer, and to indicate the hours of the day. 3d, Placing the figures and dials on the faces of the driving wheels to indicate the seconds and minutes by a continuous motion; also, to indicate the hours by a continuous or intermittent motion.

160. STRAW CUTTERS; Joseph B. Okey, Assignor to self and Wm. H. Hendrick, Indianapolis, Indiana.

Claim—1st, The combination of sliding bar, constructed as set forth, with yoke and vibrating bottom. 2d, The combination of cams with lever, constructed and used as described.

161. BREECH-LOADING FIRE ARMS; Joseph Rider, Newark, Ohio, Assignor to self and E. Remington & Sons, Ilion, New York.

Claim—The combination of the movable breech-pin and the cap tube applied to a pistol, as described. And, in combination with a hammer of the form described, I claim the arrangement of the main spring and trigger, relatively to each other, to the hammer, and to the stock and barrel, as described.

162. SEWING MACHINES; Joseph C. Silvey, New Orleans, Assignor to Thomas J. Dobyns, St. Helena Parish, Louisiana.

Claim—1st, Operating the needle-arm by means of a grooved eccentric and a pin on the needle-arm, arranged in the manner described. 2d, The construction or arrangement of the portion of the feed-plate or table through which the needle and the feeding-dog work, to form an inclined plane relatively to the direction of the movement of the feeding-dog. 3d, The combination of springs, applied in the manner described, to effect the tightening of the stitch, and otherwise control the thread between the perforating needle and its spool, by the automatic operation explained.

163. APPARATUS FOR FEEDING PEGS; Seth D. Tripp, Assignor to self and Luther Hill, Stoneham, Mass.

Claim—1st, Winding up the blank or strip of pegs with the ribbon, so that as the ribbon is wound off by the movement of the machine, the blank will be fed up in the manner set forth. 2d, Hanging the spool on a vibrating arm, so that the spool and trough may follow the motions of the swinging gate or part of the pegging machine, to which the trough is attached.

164. SCALES; Andrew Turnbull, West Meriden, Assignor to self and James B. Frary, Meriden, Connecticut.

Claim—1st, The combination of the beam lever with scoop platform attached, with the spring, rack, adjustable or fixed pinion, with index or indexes attached to its arbor, and traversing over a graduated plate or plates. 2d, Attaching or suspending loosely the rack to the beam lever, by means of a pivot, and having a spring acting on said rack in order to keep the same in gear with the pinion. 3d, Attaching the lower end of the spring to the traverse bar by means of the screw and nut, in order to regulate the tension of the spring and preserve its uniformity. 4th, In combination with the beam lever, spring, and indexes, connected with the beam lever, the stop, on the arbor, for the purposes specified.

165. CLOTHES DRYER; O. H. Waters, Baltimore, Maryland, Assignor to Alfred Hunter, Washington City, D. C.

Claim—The combination and arrangement of the adjustable grooved post, its radial arms, and box, H, with box, A, cylinder, and protector, constructed in the manner set forth.

166. LAMPS; Lewis White, Hartford, Connecticut, Assignor to self and Daniel McLaughlin, City of N. York.

Claim—The application and arrangement of the operating gears, when placed in the manner described. Also, the movable flaps, in the manner described.

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167. Planetarium; Lemuel Allen, Pekin, Illinois.

Claim—The representation of the planets and their orbits suspended on a diametric rod, and capable of rotating on said rod, within a broad belt which represents the zodiac. Also, the arrangement of devices by which the earth may be adjusted to represent its relative position to the sun, and to the plane of its orbit, at any point thereof, in the manner set forth.

168. Slide Valves in Steam Engines; Astley C. Ancona, Reading, Pennsylvania.

Claim—The corrugated valve seat, in combination with the cavities in the face of the valve, substantially the same as set forth.

169. Grain Separators; P. J. Ankney and Daniel McGreevy, New Lexington, Ohio.

Claim—1st, The oscillating hopper or trough, b, as constructed, in combination with the revolving screen, operating jointly, as described. 2d, The combination of the screen, and trough, and hopper, b, with the adjustable hopper or trough, h, and the spout, with gauge, cut-off, and valve, as described.

170. Mortising Machines; W. R. Axe, Beloit, Wisconsin.

Claim—The gauge plate and slides, in combination with the reciprocating table and adjustable table, arranged in the manner set forth.

171. Steam Engines; Horace Bertholet, Reading, Pennsylvania.

Claim—The peculiar arrangement of the bar in the slotted valve stem, and the connexion of the arms with the cylinder cocks.

172. Changeable Stencil; Jonathan Bigelow, Brighton, Massachusetts.

Claim—The character plate formed at its ends, as described, whether the same be swaged at one edge or not. Also, the stencil formed by the combination of said character plates, and a frame or frames or clamps.

173. Manufacture of Thimbles; Peter S. Bishop, Smithfield, Rhode Island.

Claim—A thimble made from plated or overlaid metal, either in the common form with fluted sides, or with sides in the form of a regular geometrical figure.

174. Washing Machine; Alpheus Bissell, Berlin, Wisconsin.

Claim—The arrangement of the false bottom, cords, pulleys, platform, and cam chuck, with the frame, provided with corrugated rubbers, with rollers, and with levers, said frame being operated by means of cranks.

175. Grain Separators; J. L. Booth, Cuyahoga Falls, Ohio.

Claim—The inclined zigzag screens, and boxes, and troughs, having a shake motion given them, and used in connexion with the revolving fan and spout.

176. Saddle-trees; J. H. Boyd, Baltimore, Maryland.

Claim—The employment of the double head or gullet plates, c and d, when the front head or gullet, d, is connected to the body of the tree by means of springs, in such manner that when the straining web is attached to said head and to the back of the tree, a spring seat will be formed.

177. Steam-pressure Indicator or Alarm; Samuel W. Brown, Lowell, Massachusetts.

Claim—The arrangement and combination of cylinder, rod, tube, and valve with each other, in the manner described, for indicating or giving the alarm with steam from the same or contiguous chamber.

178. Sash-fastener; Morgan Chittenden, Danbury, Connecticut.

Claim—The combination of a T-shaped wedge with a bolt case, having an opening corresponding thereto, whereby the two sashes are uniformly and closely secured together.

179. Hydraulic Presses; M. H. Clark, Danville, Virginia.

Claim—1st, The arrangement of the water reservoir, force-pump or pumps, main supply pipe, branches, stop-cocks, and a series of hydraulic presses, for united operation. 2d, Arranging a leather packing-ring on a disc which is divided radially into a series of parts, and fitted loosely on a conical extension of the piston, and held in contact with said extension by means of an undivided disc which is suspended loosely so as to have vertical play on a screw or head pin of the piston.

180. Apple-parer; Richardson T. Clark, Johnstown, New York.

Claim—The combination and arrangement of the paring-knife, lever, spring, r, cord, clutch drum, and spring, t, with shaft band, and pulleys, and wheels, and apple fork.

181. Stoppers for Preserve Cans; V. P. Corbett, Washington City, D. C.

Claim—The arrangement of the plate, screw, conical nut, and disc, composed of two or more sections, when the same are used in connexion with an elastic band or rim.

182. Apparatus for Reefing Sails; George B. Cornish, City of New York.

Claim—Constructing the slip bands in one piece with four flanches, a a a′ a′, the spaces between a a and a′ a′ serving as slip bands, and the central space between flanches, a a′, serving as a band on which the reef pennant is wound, said flanches serving to prevent any lateral movement of the yard, and also to prevent the reef pennant from coming in contact with, and being injured by, the quarter bands.

183. Steadying Logs in Saw-mills; Riley Doty, Cardington, Ohio.

Claim—The employment of the adjustable frames, provided with journal bearings and with rollers, the same being operated in one direction by means of the head and tail blocks, and in the other direction by means of a cord and weight, one of said frames being stationed as described, by a spring provided with a shoulder and an incline plane.

184. Lamps; John L. Drake, Cincinnati, Ohio.

Claim—The employment or use of the disc applied to the wick tube, and used in connexion with the cap, and arranged relatively with it.

185. Derricks; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The combination of the toggles and right and left screw boom, when the latter has its fulcrum movable with the pulleys, in the manner described.

186. Coffee-pots; Oliver T. Eddy, Philadelphia, Pennsylvania.

Claim—The annular cone-shaped deflecting plate resting on the bottom of the pot, and arranged in respect to the tube and perforated plate, as set forth.

187. Electro-magnetic Steam Boiler Gauge; Moses G. Farmer, Salem, Massachusetts.

Claim—The combination of an indicator, an electric circuit or circuits, one or more circuit-breakers, with a float, in any manner substantially as described.

188. Horse Power Machines; L. R. Faught, Atlanta, Georgia.

Claim—The arrangement and combination of a stationary geared rim, movable rim, supporting bar fitted in the pinions, c c, the shaft, G G, provided with pinions, F F, and wheels, and the shaft, F′, as set forth.

189. Method of Operating Crozing Knives; George Finn, Oswego, New York.

Claim—Arranging the cam that works the cutter on the bevel-wheel, so that it will not occupy more space on the arm that carries them than that occupied by said bevel-wheel, for the purpose of simplifying the mechanism and economizing space on said arm, which is necessarily limited in length.

190. Railroad Car Seats; Eli Wheeler, Elmira, New York.

Claim—1st, The arrangement of box-formed supports, cushions, and cushioned seat backs of a pair of car seats, in the manner specified, whereby when the bottoms of the seats are turned over, to fill up the space between the seats, the bed-clothing contained in the box will be exposed so as to be readily removed, and then, when the backs are turned down to fill the place occupied by the bottoms, the said boxes will be closed up and a continuous bed formed from one back edge to the other of the seat. 2d, The short open stationary partitions, in combination with sliding-panels, which, when elevated, serve as head and foot boards, and allow ventilation under and above the berth during night time, and when lowered during the day time, afford more room to the upper portion of the body of passengers, as they pass through the aisle of the car. 3d, The short sliding-closed blinds, arranged to operate as described, and serve as foot and head-boards, and allowing ventilation above and below the upper berth, in combination with the upper berths and partitions.

191. Furnace and Apparatus for Treating Pyritous Ores; John Fretz, Angel, California.

Claim—1st, The hollow stationary cylinder, its revolving worm, and its openings, for the admission of the pyrites, and the introduction of air and discharge of the fumes of sulphur, in combination with the rotating cylinder and its internal ribs, the said stationary and rotating cylinders communicating with each other through a pipe, arranged in respect to the furnace, as set forth. 2d, The system of vertical boxes or chambers communicating with each other, with the steam pipes, the rotating cylinder, and the exit pipe.

192. Machinery for Warping Yarn; Richard Garsed and Clayton Denn, Philadelphia, Pennsylvania.

Claim—1st, The form of the drop wires, arranged in the manner specified. 2d, The cylinder, for the purpose of marking the cuts. 3d, The employment of a register, constructed as specified, for the purpose of registering the number of cuts while the machine is in motion. 4th, The employment of the bar for the purpose of taking the leas, constructed with fingers either on one or both sides. 5th, The combination of the vibrating tube, the stationary hook, the movable hook, and the pin, for the purpose of forming the yarn into links, constructed in the manner described.

193. Churn; Samuel Gissinger, Alleghany, Pennsylvania.

Claim—The arrangement in the movable frame of the oscillating churns, furnished with dashers and wings, in combination with the revolving shaft armed with wings, arranged as described.

194. Galvanic Battery; Eugene Grenet, Jr., Paris, France.

Claim—1st, The method of agitating the exciting liquid of a galvanic battery by forcing a current of air through it, in the manner set forth. 2d, Arranging and constructing the zinc and charcoal elements, in combination with the exciting fluid, in the manner described, whereby they may be operated, the one by the other. 3d, Forming the charcoal elements by pressing into or on to the surface of plates of lead, when yet in a semi-liquid state, small pieces of charcoal, in the manner described.

195. Gauge and Box for Casting Journals in Soft Metals; C. W. Griffith, Dayton, Ohio.

Claim—In combination with a hollow box, a loose removable gauge or centering plate, fitted and fastened to, or held against the box, so as to hold the shaft in its proper position in the box, and at the same time retain or prevent the melted metal that is poured into the hollow box, to form a box around the shaft, from running out.

196. Apparatus for Cooling Liquids; Valentine Hall, City of New York.

Claim—The employment or use of one or more receivers placed within a tank, and connected with the barrel or cask by means of a siphon, and with a pump within or at the outer side of the tank, for the purpose set forth. Also, combining a pump with one or more receivers, connected together and made to communicate with each other by siphons, when said parts are submerged within a tank, and made to communicate with a cask or barrel, by means of a siphon extending over the top of the tank.

197. Lamps; Halvor Halvorson, Cambridge, Massachusetts.

Claim—1st, The employment or use of the valve in connexion with the wick tubes, for the purpose of regulating the supply of air to the interior of, or between two planes of the wick. 2d, The arrangement of the shaft and their wheels, so that the wheels on one shaft may gear into those on the other, for the purpose of raising and lowering the wicks simultaneously by the turning of one shaft.

198. Trolling-bait for Catching Fish; Riley Haskell, Painesville, Ohio.

Claim—1st, Constructing the body of an artificial representation of a natural fish in two detached parts, to be used in combination—one portion thereof revolving, and the other remaining fixed or stationary, both portions being on one shaft. 2d, In connexion with my first claim, filling the upper part of said fixed portion with a light substance, and weighting the lower part thereof, for the purpose of keeping the said fixed portion vertical in the water.

199. Tailors' Shears; Rochus Heinsich, Newark, New Jersey.

Claim—Constructing the lower bow with its upper portion widened, and with the projection thereon, so as to form a bearing for the fore-finger within the bow.

200. Variable Exhaust for Steam Engines; W. M. Hurlbert, Northfield, Vermont.

Claim—Applying the slides to operate in elbows or inverted L-shaped nozzles, arranged as described.

[This invention consists in making the upper ends or nozzles of the blast pipes each in the form of an elbow or the inverted letter L, and fitting the regulating slides to the horizontal portions of the elbows, so that both can be adjusted simultaneously by right and left-handed screws on the same shaft, thereby providing very conveniently for the variation of the area of the openings.]

201. Steam-trap; E. T. Jenkins and F. B. Polley, Williamsburgh, New York.

Claim—The round pipe, in combination with the valve seat, valve, ring, opening, and float, arranged in the manner described.

202. Boilers; Christian Kieffer, Lancaster, Pennsylvania.

Claim—The construction of the extension and perforated steam-pipe, with the extension hot air flue, with the pan, with pipes, I I, and perforated pipe, K, arranged as described.

203. Bung-hole Borer and Reamer; Josiah Kirby, Cincinnati, Ohio.

Claim—The conical-shaped stock, when made with a throat cut through from the edge of the bit on one side, to the opposite side of the stock, so that the shavings are made to pass through the stock and out on the opposite side. Also, the combination of the auger bit with reamer, made in the manner described.

204. Seed Planters; Levi L. Lancaster, Rocky Mount, North Carolina.

Claim—The frame, wheels, hopper, cylinder, pockets or depressions, carrying tube, furrow-opener, coulter, leveler, and bottom, arranged as described.

205. Thermometric Regulator for Heating Apparatus; Lewis W. Leeds and Calvert Vaux, City of New York.

Claim—So applying the vessel, which we have termed the secondary heater, containing the fluid to act upon the piston, or its equivalent, in combination with the primary heater, and so applying the piston, or its equivalent, in combination with said secondary heater and with the regulating valve, that the secondary heater is exposed at the same time to the heating influence of the primary heater and the cooling influence of the incoming cold air, and the fluid contained therein is, by its expansion and contraction, made to control the admission of the steam or other heating agent, and cause the supply of such agent to the heater to vary inversely with variations in the atmospheric temperature.

206. Approach-opening Gate; Julius S. Lloyd, Philadelphia, Pennsylvania.

Claim—Operating the angular bar by means of the carriage, with its pulleys and guard, in combination with the projecting arm of the rod, and the cranked and weighted rods, and the respective cords or chains, arranged as set forth.

207. Water Indicator for Steam Boilers; George Lutz, Logan, Ohio.

Claim—1st, Operating auricular and visual alarms, either severally or conjointly, at will, by mechanism such as is described. 2d, The combined index and tripping levers, arranged in the manner set forth. 3d, The combination of the tripping levers, balance lever, and bifurcated rocking lever, as described. 4th, The combination of the catch and dogs, arranged as set forth. 5th, The combination of the bent lever, thumb-screw, and slotted bracket, as described.

208. Method of Making Soap; Augustus Miller, Grafton, Ohio.

Claim—Soap manufactured from the herein-named ingredients and chemicals, when the same are compounded in the manner specified.

209. Iron Spoons; G. I. Mix, Wallingford, Connecticut.

Claim—1st, The method, substantially as described, of making the handles of iron spoons. 2d, Forming a tongue upon the bowl blank, and a corresponding recess or inlet upon the handle, or vice-versa.

210. Carpet fastener; George G. Noyes, Worcester, Massachusetts.

Claim—The bar, provid d with the hooks, knife-edge, and spurs, so that it may be readily secured to, and detached from, the base-board and floor.

211. Railroad Chairs; W. A. Nugent, Susquehanna Depot, Pennsylvania.

Claim—The shell or body with the cam jars and the chair, arranged as specified.

212. Horizontal Water-wheel; John K. O'Neil, Kingston, New York.

Claim—The arrangement of the guide partitions, cylinders, wheels, and wheels or buckets, in the manner specified.

213. Composition for Tanning; Thomas S. Page, Milan, Ohio.

Claim—A liquor composed of terra japonica, sulphate of alumina and potassa, muriate of soda, nitrate of potash, and sulphate of soda, when combined in the proportions described.

214. Boring and Mortising Machine; Collin G. Pollock, Cincinnati, Ohio.

Claim—The arrangement and combination of the bar on the arbor, projection on the upright lever, connected with the arbor by the knuckle-joint, and the bevel gear, for joint operation.

215. Feeding Paper to and from Printing Presses; Charles Potter, Jr., and C. B. Cottrell, Westerly, Rhode Island.

Claim—The securing of the registering points firmly to a fixed portion of the machine, and releasing the paper therefrom at the proper time by elevating the adjacent surface. Also, depositing each sheet face upwards on the pile, by carrying it between a vibrating series of tapes, operated in the manner set forth. Also, the arrangement of the cylinders and the series of tapes, or their respective equivalents, in the vibrating frame, which vibrates on the shaft as a centre, and receives its proper vibratory motion from the hook, or its equivalent, whereby the frame may be readily unhooked and swung out of the way to allow access to the bed of the press without deranging or disturbing any of the mechanism.

216. Burners for Vapor Lamps; William H. Racey, City of New York.

Claim—The burner and curved rods, one or more, in combination with one or more deflecting caps and draft tube, arranged as set forth.

217. Insect Powder-blower; Peter Reynard, City of New York, and Victor Varin, Brooklyn, New York.

Claim—The divisions in the powder-chamber to insure the powder being in a position to be acted on by the air blown through the perforated diaphragm. And in combination with said powder-chamber, we claim the india rubber perforated ball, fitted and acting to give the blast of air.

218. Threshing Machines; Joshua Rollman, Sinking Springs, Pennsylvania.

Claim—The application to a threshing machine of one or more independent fan-blowers, which are attached outside of the machine, and in such position as to prevent any dust, arising from the operation of threshing, from reaching the attendant on the machine, arranged in the manner described.

219. Horse Power Machines; Gelston Sanford, Poughkeepsie, New York.

Claim—1st, The combination of the internal toothed wheels and their connected pinions with the hollow standard, arranged in the manner set forth. 2d, The combination of the hollow standard with the shaft and its connected gearing, in the manner described. 3d, The combination of the adjustable bearing or frame with the hollow standard and shaft.

220. Tops for Tables; Nathan Sargent, Charlestown, Massachusetts.

Claim—A panoramic table or table-top, constructed in the manner set forth. Also, the peculiar mechanism whereby the canvass or panoramic cloth is maintained with proper tension upon each of the rollers, however such cloth may vary in thickness or in number of folds upon such rollers.

221. Straw-cutters; Casper Schultze and J. Frederick Schroeder, Covington, Kentucky.

Claim—A cutting box, constructed with adjustable compound knife-wheel, in combination with feeding chute, arranged as described.

222. Machine for Making Sewing Machine Needles; Wm. W. Shipman, New Haven, Connecticut.

Claim—The feeding plier formed by the lever and block, in combination with the punching die, P2, and die, P3 and 21 31, the cutter and clamp formed by J J and I I, the whole in combination as set forth.

223. Electrical Heating Apparatus; George B. Simpson, Washington City, D. C.

Claim—The insulation of the metallic coil or helical electrode, which I call an electro-heater, and the successful generation of heat by passing currents of electricity over a coil or coils of platina, or other metallic wires resting on, and supported by, a non-conducting electrical base, or encased in metallic tubes, or open vessels insulated with any of well known substances non-conducting of electricity, as described.

224. Mode of Constructing Matrices, &c.; John Joseph Charles Smith, Covington, Kentucky.

Claim—The discovery of rendering composition or alloy of copper and tin pliable, and in such a state as to admit of an easy impression of any figure or design on or in metal, whether engraved or produced by means of electrotyping, as a copy of any figure, design, or object, thus yielding a perfect matrix or mould—and this process I further claim, as my invention, in connexion with the manufacturing of types of the alloy of copper and tin, as already described, and which will and shall produce the intended effect.

225. Making Lightning Conductors; Charles Stearns, Lowell, Massachusetts.

Claim—The twisting rollers, constructed as described, in combination with the corrugating rollers, for producing the corrugated twisted copper rod.

226. Horse-rakes; Theodore J. Steffe, Lancaster, Pennsylvania.

Claim—The arrangement and combination of the teeth heads, key, spiral spring attachment, lifters, lever, cleaners, when these several parts have their centre of motion on the axle of the machine. Also, in combination with the above, the foot-brace, hinged at slide and slot, as specified.

227. Hominy Mills; George Strause, Boonsboro', Maryland.

Claim—Giving to the shaft substantially the shape represented, when the said shaft is armed with toothed segments, and is also operated within a tube which is also armed with counteracting segments.

228. Bridges; David H. Van Duzer, Sugar Loaf, New York.

Claim—In combination with the blocks, E F G H I, rods, blocks, C C', and bolts, arranged as shown, the arrangement of the plates, as described.

229. Take-up for Trimming Looms; Samuel Walker, Roxbury, Massachusetts.

Claim—Giving to the take-up roll of a trimming loom a reciprocating motion longitudinally on its axis, for the purpose specified.

230. Photographic Printing Machine; Charles Fontayne, Cincinnati, Ohio.

Claim—1st, The described machine for printing or multiplying photographic pictures. 2d, The described art of multiplying positive photographic pictures or expressions from the same negative upon the same sheet of sensitive paper, or other material. 3d, Causing the sensitive material used for the reception of photographic impressions, latent or otherwise, made by the agency of solar or other light, passing through a negative, to traverse the aperture or negative employed. 4th, The traversing bed, whether cylindrical or plane, confined within a dark chamber, whose surface may be moved by ratchets, screws, cranks, or their equivalents, for the purpose of carrying the sensitive material when the same is used in connexion with a negative, from which it receives positive impressions. 5th, The employment of continuous sliding or revolving discs, with springs and spring-stops, or their equivalents, to give them a uniform motion and overcome the momentum or rebound, for admitting and shutting off light uniformly to and from all parts of the surface to be acted upon in printing positive photographic pictures from a negative. 6th, The application of a lens or lenses for the purpose of condensing light, when used in combination with negative 28, the sensitive material, and slide or cut-off, for admitting or shutting off light, for the purpose of photographic printing. 7th, The combination of condensing lens, 33, negative, 34, daguerreotype tube, 75, with its lenses, 76, the sensitive material and slide or cut-off for photographic printing. 8th, The combination of the sensitive material, negative, 28 (as destinguished from negative, 34), and slide or cut-off, for the purpose of photographic printing. 9th, The method of raising the glass negative or other matrix, 28, from the sensitive material, to permit the motion of the latter, and the method of lowering again. 10th, The method of supporting and adjusting negative, 28, as described. 11th, The use of the glass negative (when negative 28 is used), or the use of a piece of plain glass in the place of it (when negative 34 is used), or the use of a skeleton frame, for the purpose of pressing the sensitive material smoothly and evenly on roller 5, or traversing bed, while the photographic impression is being made. 12th, The alternate admission and exclusion of light passing through a negative, to act upon a traversing sensitive material, confined in a portable dark chamber. 13th, The rod, 8, working through hollow slotted shaft, 6, and affixed to roller, 5, by plate, 9, for the purpose described. 14th, The combination of the lever, 12, with its spring-catch, 13, with the ratchet wheel, 14, nose, 82, of shield, 15, and slotted stop, 11.

231. Cut-off Gear for Steam Engines; Henry Whittington, Philadelphia, Pennsylvania.

Claim—The inclined spiral edges on the revolving and sliding sleeve, when the latter is applied to operate the cut-off valve, the descent of which is caused by the pressure of steam above the valve, and when the inclined edges serve to retard the descent of the valve.

232. Washing Machine; Asbury Wilkinson, Madison, Indiana.

Claim—The combination of circular boards suspended from a frame above by springs, with a rotary corrugated roller working between them, constructed as set forth.

233. Registering Apparatus; Jephtha Avery Wilkinson, Brooklyn, New York.

Claim—A series of counting discs standing at right angles, or nearly so, to each other, and each formed with a thread or worm around its periphery taking teeth on the next counting disc, in the manner specified. Also, the arrangement of the counting disc, p9 and p10, in the manner specified, whereby they can be disconnected and set to commence counting when required.

234. Try-cock for Steam Boilers; John F. Cook, Assignor to self and George F. Page, Baltimore, Md.

Claim—Combining with the barrel of a try-cock a two-armed lever, one provided with springs or weights, and the other with a rubber (or other equivalent disc), so that the weighted arm shall hold the valved or disc arm against the bore of the barrel of the cock, as described.

235. Railroad Chairs; Henry W. Gray, Cleveland, Ohio, Assignor to self and W. H. Alvord, Homer, N. Y.

Claim—The forming the railroad chair in two sections, having the outer surfaces convex, in combination with the gripe and beam, arranged in the manner set forth.

236. Presses; Horatio Francis Hicks, Assignor to Hicks Brothers, Grand View, Indiana.

Claim—The combination of stepped bearings, with rollers adapted to operate in connexion therewith, without endwise pressure or tendency to displacement, in the manner set forth.

237. Deep Sea Sounding Apparatus; George W. McCord, Assignor to self and J. F. Lobdell, Centralia, Ill., and V. N. Davis, Rush, New York.

Claim—The arrangement of the cylinder, piston, graduated scale, cap, and vernier or register, constructed as described, for the registration of marine soundings upon the principle of hydraulic pressure.

238. Machine for Shaping and Finishing the Backs of Books; G. H. Sanborn, Boston, Mass., and John E. Coffin, Portland, Maine, Assignors to G. H. Sanborn, aforesaid.

Claim—1st, The employment, for shaping or finishing the backs of books, of a divided roll or pair of segments, operating across the backs from the centre to both sides thereof. 2d, The combination of the cam, T, slide, toggle, P P, spring, link, Y, lever, link, U, and toggles, F F, with the book-holder, for the purpose of raising the holder and causing it to close upon the book before each operation of the divided roll or pair of segments. 3d, Attaching the segment levers, G G′, or their equivalents, to levers, H H, operated by cams, N N, on the constantly revolving main shaft, for the purpose of throwing the segments out of the way of the holder, at the proper stage of the operation of the machine, to permit the removal and introduction of the books.

239. Stoves; Thomas Shaw, Assignor to self and J. C. Bailey, Philadelphia, Pennsylvania.

Claim—1st, The adjustable legs, when combined with the casing and its gauge cylinder, and arranged so as to serve the double purpose of tilting the stove more or less on one side, and regulating the admission of air into the casing. 2d, Operating the valve for regulating the flow of gas into the casing, by means of the object to be heated by the flame, in conjunction with the devices set forth, or their equivalents.

240. Converting Reciprocating into Rotary Motion; A. T. Underhill, City of New York, Assignor to C. R. Underhill, New Castle, New York.

Claim—The arrangement and combination of the frame, guards, and ratchet wheels, so that the rotation of the shaft may be reversed, as set forth.

241. Machinery for Perforating Hat Bodies; Wm. F. Warburton and Wm. B. Atkin, Assignors to Wm. F. Warburton, aforesaid, Philadelphia, Pennsylvania.

Claim—1st, The system of pointed pins, hung independently of each other to the cross-head, furnished each with a separate spring, and arranged in combination with the hat block attached to the face plate on the spindle. 2d, The ratchet wheel of the same form, or thereabouts, as that presented by a transverse section of the hat to be perforated, in combination with the face plate and its hat block, the said wheel being operated by the pawl and the appliances connected therewith, or their equivalents, in the manner set forth.

242. Mode of Distilling Liquids from Coal Tar; Morris L. Keen, Rogers' Ford, Pennsylvania.

Claim—The application of additional heat at or near the surface of the coal tar, or other similar hydrocarbon, when used in combination with pressure in the boiler, for the purpose of preventing the tarry foam from rising and over-running the still, and thus endangering the operator as well as the premises.

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243. Churn; Abel Austin, Altona, Illinois.

Claim—The arrangement of the shaft, cranks, dashers, handles, links, springs, c c c, box, spring, g, and lid, constructed as described.

244. Rotary Blower; Wm. B. Barnard and Edmund Jordan, Waterbury, Connecticut.

Claim—The diaphragm, in combination with the revolving propeller or propellers to deflect the blast to the mouth or opening, as the blower revolves in the case.

245. Camp Stool; Elbridge G. Belknap, Philadelphia, Pennsylvania.

Claim—The combination of the case and the seat frame with the swivel blocks, braces, and connecting rod, arranged in the manner described.

246. Seed Planters; Lewis Reese Carpenter, Lancaster, Ohio.

Claim—The arrangement of the beam, handles, braces, furrowing scraper, and seed box, with the planting slide, lever, wheel, and covering scrapers, constructed as described.

247. Machines for Preparing Tobacco for Pressing; Edwin S. Collin and Thomas N. Reed, Aspen Wall, Virginia.

Claim—The arrangement of two, three, or more pairs of progressive pressure rollers with each other, in the manner set forth. Also, combining a series of oil vessels and oiling pads with the aforesaid pairs of pressure rollers, in the manner set forth.

248. Machines for Splitting Welts; John Critcherson, and Eri S. Moulton, Boston, Massachusetts.

Claim—The beveled grooves, arranged in reference to each other, on the cylinders, and operating in combination with the adjustable cutter, as set forth.

249. Harvesters; Tobias Crumling, Hellam, Pennsylvania.

Claim—The arrangement and combination of the independent platform with the frame, belt, and driving axle.

250. Reels for Harvesters; George S. Curtis, Chicago, Illinois.

Claim—The employment of sliding heads, and pivoted arms, and bars, in combination with the reel shaft and beaters, described so that the diameter of the reel can be expanded or contracted.

251. Harvesters; Jacob D. Custer, Norristown, Pennsylvania.

Claim—1st, The main shoe, constructed in the manner described, in combination with bars of main frame and supporting bar, in the manner described. 2d, The caster wheel, in combination with the lever and adjustable plate, arranged in the manner described.

252. Telegraphic Cable; J. S. Davison, Cranberry, New Jersey.

Claim—Arranging a series of loose metal strips in a coil, or its equivalent, as described.

253. Bedstead; Eben Eaton, Cincinnati, Ohio.

Claim—The construction of bed-posts with the wedge-formed part and the square piece attached, so as to form a shoulder to receive the rail, in combination with the bottom or platform of a bedstead, with the rail formed so as to fit the posts described, and all permanently connected together by means of cross-pieces.

254. Mode of Coloring Woolen Hats; G. D. Foote, Danbury, Connecticut.

Claim—The described process of restoring the color of the hats after they have been dipped in the stiffening and rubbed off by sand paper, by applying the hot dyeing liquid.

255. Rolling Mills; John and George Fritz, Johnstown, Pennsylvania.

Claim—The application to each of the pairs of drawing or forming rolls of a feed roll, such as described, and driven by gearing or other machinery, and turning in the same direction with said drawing or forming rolls, for the purpose of carrying and feeding into them the pile or bar of heavy iron.

256. Apparatus for Washing Gas; Harvey Guild, New Orleans, Louisiana.

Claim—The arrangement of the water-pipe and rose within the inlet pipe of the wash-box, in combination with the perforated plate or diaphragm, at the junction of the inlet pipe, with the wash-box.

257. Belt-hook, Pliers, and Punch; N. E. Hale, Nashua, New Hampshire.

Claim—1st, The combination of the roughened surfaces with the triangular wedge end, arranged in relation to each other, as set forth. 2d, The combination of the jaws with the punch, roughened surfaces, and wedge end, constructed as set forth.

258. Method of Distilling Oil from Coal; John Howarth, Salem, Massachusetts.

Claim—Forming oleaginous vapor from coal, or other substances, yielding pyrogenous oils, by passing through the material to be acted upon, a current of superheated steam, in combination with steam direct from the boiler, in the manner set forth. Also, forming oleaginous vapors from coal, or other substances, yielding pyrogenous oils, by passing through the material to be acted upon, air combined with superheated steam, in the manner set forth.

259. Bedstead Slats; Tyler Howe, Cambridgeport, Massachusetts.

Claim—The described bed slat, consisting of the lifter, in combination with the slat, constructed in the manner set forth. Also, the construction in the ends of slats, by which they are connected with the bedstead or springs, as described.

260. Mode of Arranging Couches in Railroad Cars; Edward C. Knight, Philadelphia, Pennsylvania.

Claim—The arrangement of couches in railroad cars by means of the double-hinged rod, constructed in such a manner that the couch, when not in use, may be folded up against the ceiling and retained there by means of a button, or other suitable device.

261. Screw-wrench; W. Kuhlenschmidt, City of New York.

Claim—The arrangement and combination of the conical disc with the helical groove, the spring, the movable jaw, and the shank, to operate as set forth.

262. Moulding Water-traps; James Allen Lowe, City of New York.

Claim—The application of a metallic core, constructed and operating as described, to cast water-traps.

263. Cooking Stoves; James L. Meafoy, Middleton, New York.

Claim—The cylindrical fire chamber and air chamber, communicating with the fire chamber and the heater chamber, arranged relatively with each other and the oven, for the purpose set forth. Also, in combination with the fire chamber, air chamber, and heater chamber, arranged as shown, the perforated plate placed in the flue relatively with the fire chamber.

264. Machines for Distributing Fertilizers; Z. N. Morrel, Cameron, Texas.

Claim—The combined arrangement of the single side-wheel, distributing wheel, regulating slide, revolving arms, boot, set-screw, shares, cog-wheels, draft rod, sprocket wheels, roller, and chain, in the manner set forth.

265. Process of Distilling Oils from Coke; George Mowbray, Green Point, New York.

Claim—In the manufacture of coal oils and other pyrogenous oils, by exposing the coal, or other materials, to the products of combustion generated in a separate furnace. I claim igniting said products of combustion, previous to admitting the same into the distilling kiln, by admixture of a sufficient proportion of air, to burn the oxide of carbon into carbonic acid.

266. Writing-tablet; George Munger, New Haven, Connecticut.

Claim—An argillaceous surface wood writing-slate, which is formed by uniting several layers of veneering or thin wood together, so that their grains run antagonistic to one another, and then coating the exterior surfaces of the compact mass with a composition of slate, emery, or other similar argillaceous material.

267. Bed-spring; S. D. Newbro', Lansing, Michigan.

Claim—The employment of the oblong plates, whether made of wood or of metal, or any other suitable material, when the same are secured together, as set forth.

268. Manufacture of Wire Cloth; Rufus Nutting, Randolph, Vermont.

Claim—Compressing wire cloth by passing it between rollers suitably constructed, or by equivalent means, whereby its surfaces are rendered smooth and even, in the manner specified.

269. Stoves; Oscar Paddock, Watertown, New York.

Claim—The damper arranged over the pipe through which a direct communication between the fire-place

and the chimney is effected and operated by means of a rod, or its equivalent, which is secured to the door, and which acts against a forked lever, as specified.

270. MANUFACTURE OF HOES; Andrew Patterson, Birmingham, Pennsylvania.

Claim—Forming the head or eye of a hoe and attaching it to the blade at the same time, by pouring the molten metal to form the head on or around the blade.

271. CONSTRUCTION OF PACKING-BOXES; Edward L. Perkins, Roxbury, Massachusetts.

Claim—1st. Forming the sides, ends, bottom, and top of the box with, or attaching thereto, the right angular shaped braces or shoulders formed with beveled corners, so as to make a close and binding joint. 2d, In combination with the above, I claim the cover formed in two wedge-shaped pieces, or in any manner substantially similar, whereby all the parts constituting the box are drawn and held rigidly together.

272. MUFFS; Jane Phillips, City of New York.

Claim—A muff, arranged with a cut in its side covering or shell, an annular space or pocket, and a porte-monnaie secured in its inner part.

273. HOOPS OF SKELETON SKIRTS; Joseph F. Pond, Cleveland, Ohio.

Claim—The combination of the eye on one extremity of the hoop, with the series of set-offs on the other, constructed as set forth.

274. SECURING IRON BANDS ON COTTON BALES; C. W. Pyle, Galveston, Texas.

Claim—A plate, constructed with a short open slot, a long closed slot, and a turned down lip or flanch.

275. SPRING HINGE; Cornelius J. Rooney and David Renshaw, City of New York.

Claim—The arrangement of the coiled spring, shaft, and wings, in combination with each other, for the purposes stated.

276. BURGLARS' ALARM; Abbott Q. Ross, Cincinnati, Ohio.

Claim—Connecting the doors or windows of a house to an alarm mechanism, through a system of strained wires, so that the forcing of a door, or the cutting of any wire shall let off the alarm mechanism. Also, connecting the panels of a door with the strained wires that unite the door with the alarm mechanism, as that the cutting out of a panel, or the cutting of one of the wires, shall let off the alarm mechanism. Also, the combination of the swinging lever on the door, with the bolt and its inclined plane that locks the spring drum, for the purpose of putting said door in connexion with the alarm mechanism, when said door is drawn to, and shut from the outside.

277. HORSE HARNESSES; John Rouse, Port Gibson, New York.

Claim—The double-eyed hook, arranged as described in the yoke ring, so as not to be withdrawn therefrom, in combination with said ring and with the divided hame straps, which are respectively secured to the opposite eyes of the hook.

278. STEAM PUNCHING MACHINE; John Sparrow, Portland, Maine.

Claim—The employment of a single-acting cylinder and piston, operated by the pressure of steam, water, or other fluid, and a toggle, arranged relatively to each other and the punch or cutter, as described.

279. METHOD OF OPERATING INDEPENDENT SECOND HANDS OF STOP-WATCHES; Peter M. Satzell, Philadelphia, Pennsylvania.

Claim—1st, The independent second hand adapted to a watch, so that by means of the devices described, or their equivalents, the said hand may be connected to, or disconnected from, the time train of the watch, without interfering with the movements of the latter. 2d. The stop-arm, with its forked end so adapted to the hollow arbor as to serve the purpose of stopping and releasing the said arbor, and at the same time serving to maintain it in its proper vertical position. 3d. The wheel with the springs, in combination with the hollow arbor of the independent seconds hand, the wheel being hung loosely to, and the spring bearing against, the said arbor.

280. SAFETY ENVELOPE; William J. Stetson, Baltimore, Maryland.

Claim—The mode of giving security to letter, and other envelopes, the same consisting in water-proofing that part of the envelope upon which the adhesive material is applied.

281. CONSTRUCTION OF GAS BURNERS; John Stevens and John Johnson, City of New York.

Claim—The apertures, in combination with the movable slide, or its equivalent, whereby the area of the passage for the gas or vapor is contracted at pleasure at the point of its exit in the atmosphere, and the volume of the flame diminished, without substantially changing its character. Also, the arrangement of the branches, diverging from a single pipe, and pressing by their elasticity against the opposite side of the slide, for the purposes explained.

282. CHAMBER UTENSIL; J. C. Stoddard, Worcester, Massachusetts.

Claim—A chamber vessel provided with a flanch and elastic ring, made as described, so as to form a tight joint, and also to prevent noise.

283. MACHINES FOR SCOURING AND HULLING BUCKWHEAT; Joseph N. Treadwell, Redding, Connecticut.

Claim—The arrangement of the revolving and graduated screws with the hoppers, conveyors, blasts, and conductors, in the manner described.

284. SMUT MACHINES; Richard Ward, Edinburgh, Indiana.

Claim—The employment of the corrugated iron plate, having the horse-shoe perforations, in combination with the iron plate having the diamond perforations, in the construction of a perforated scouring and separating cylinder, arranged to operate as set forth.

285. SEED PLANTERS; S. J. Wasterburg, Altona, Illinois.

Claim—The arrangement of the block provided with chambers, C, and chambers B, with the rods, shaft handle, hopper, spring, i, slides, and spring, G, as set forth.

286. STOVES; C. L. Whitney and Samuel Reed, Geneseo, Illinois.

Claim—1st, The arrangement of deflecting plate, chamber, graduating damper, and flue-pipes, in the four corners of the oven, all in combination for the purposes set forth. 2d. In combination with this, we claim the use of pipes of clay, or other similar material, arranged in the manner set forth.

287. ABDOMINAL SUPPORTER; A. B. Weaver, Carthage, Indiana.

Claim—The employment of the hip bands and centre hip straps, in combination with the straps, arranged as set forth.

288. METHOD OF RAISING WATER BY ANIMAL POWER: Zatter F Wilder, Painted Post, New York.

Claim—The arrangement of a series of platforms, in combination with a pump, so that a series or a succession of strokes of the pump piston shall be produced before the cattle arrive at the drinking trough.

289. HAND PUNCH; Reuben Wood, Grand Ledge, Michigan.

Claim—1st. The peculiar relative arrangement of the two series of inclined planes, in the contact faces of the circular plates, to be used either with or without interposed balls or rollers, in the manner specified. 2d. The use of the slotted tube, in combination with the two inclined ways and cross-bar (with or without the rollers), for the purpose of extricating and lifting a punch, or other tool, in the bar, by a reversed motion of the lever.

290. COTTON GINS; John Wilson, Anderson C. H., South Carolina.

Claim—1st. The employment of three or more toothed or serrated cylinders, arranged and disposed so as to operate as set forth. 2d In connexion with the cylinders thus arranged and disposed, the rotating stripping brushes and adjustable plug or register, to ensure respectively the proper discharge of the lint and the seed.

291. MANUFACTURE OF SHEET METAL; Henry W. Wimshurst, Dalton, England.

Claim—The improvement in the manufacture or production of sheet metal or metal foil, by cutting the same from a block or solid mass, by means of a cutting mechanism, in lieu of rolling or beating the same by means of, rolling or beating mechanism, as has heretofore been done.

292. DOOR SPRING; O. D. Barrett, Assignor to self and J. F. Keeler, Cleveland, Ohio.

Claim—The levers, in combination with the connecting rod and the springs, constructed as specified.

293. STAVE MACHINE; James Decker, Assignor to self and A. P. McRae, Reidsville, Georgia.

Claim—The combination and arrangement of the convex and concave cutters, bed-piece, tonguing and grooving cutters in the heads, and the cam, attached to the pressure hub or roller, and lever connected with the said cam, and the shaft of cutter head, as set forth.

294. MANUFACTURE OF CIGAR-WRAPPERS; Francis Dixon, Lynn, Assignor to self and Moses Sweetzer, Newburyport, Massachusetts.

Claim—A new article of manufacture, the same consisting of tobacco leaf reduced to pulp, and converted subsequently into sheets, or other desirable form suitable for use, or in the making of cigar-wrappers.

295. MACHINE FOR SHAPING HEELS FOR BOOTS AND SHOES; Luther Hall, Assignor to self and S. S. Hemenway, Boston, Massachusetts.

Claim—The combination of the stationary bed-plate, the movable cutter-carriage, provided with self-adjusting cutters and carriers, adjustable clamps, a guide friction wheel, and a curved rack and pinion, arranged as set forth. Also, combining with the adjustable clamps an adjustable holder and former, so constructed and arranged as not only to co-operate with the clamp in maintaining the heel of the boot or shoe firmly in position but to serve as a pattern, to give the heel any desirable contour on its bearing surface. Also, the peculiar construction of the secondary cutter carriage set forth, and the arrangement of the secondary cutter with respect to the primary cutter, the guide friction wheel, and the heel-tread former, whereby the secondary cutter is rendered capable of giving to the lower or bearing surface of the heel any form that may be desired.

296. BUNGS OF CASKS; John Keane, Assignor to self and Andrew McLean Wood, City of New York.

Claim—Providing a bung or spigot, with reservoir for spirit, and a system of pipes or passages, or their equivalents, so arranged as to cause all the air entering the cask to pass through the spirit in said reservoir. And in combination with such a reservoir and system of pipes or passages, or their equivalents, I claim a valve, applied to the bung or spigot.

297. PORTABLE GAS-HOLDER; James McFarlan, Assignor to James McFarlan, Jr., and E. McFarlan, Brooklyn, New York.

Claim—The construction of the gasometer, with its upper portion of conical form, with flexible sides and with a stiff head, and of such size that it may be introverted within the stationary tank-like portion to which its flexible sides are attached

298. GRAIN SEPARATORS; Jefferson Nash, Janesville, Assignor to Alonzo K. Cutts, Fulton, Wisconsin.

Claim—The arrangement and combination of the vibrating lever, the elbow crank, and the rods, whereby the motion of the shoe can be changed from a longitudinal to a transverse direction, and vice-versa.

299. MAKING GAS FROM WOOD; August Schmidt, Assignor to self, Charles, Edward, and Herman Schmidt, City of New York.

Claim—The arrangement of the arch-shaped retort and narrow flues with the arch of the retort, in the manner specified.

300. MAKING GAS FROM ROSIN; August Schmidt, Assignor to self, Charles, Edward, and Herman Schmidt, City of New York.

Claim—The retorts and its flues, combined with the receptacle or kettle, and arranged in the manner specified.

301. APPARATUS FOR THE PRODUCTION HARE'S HYDRO-OXYGEN LIGHT; George Hand Smith, Assignor to S. O. Smith, Rochester, New York.

Claim—1st. The use of carbureted hydrogen of gas, in combination with the atmospheric air or oxygen gas, in proportions desired, operating under condensation through a proper regulator, and discharging through jets of minute orifice upon, and rendering incandescent any proper radiating material of any form, being independent of any atmospheric circumstances or situation, in the manner and through the means and machinery. 2d. The arrangement of four jets or burners for directing the impact of gases on incandescent surfaces, such burners having minute orifices pointing to a common centre, three of them placed so that their orifices of discharge shall be within, or nearly within, one quarter of the circumference of a circle drawn through them from the centre to which they point (being not more than one-eighth of such circumference distant from each other), and the orifice of the fourth being diametrically opposite in such circle to the middle orifice of the other.

EXTENSIONS.

1. COOKING STOVES; C. J. Woolson, Cleveland, Ohio; patented September 9, 1845; extended Sept. 13, 1859.

Claim—The forming of the bottom plate of the oven with a number of tubes or boxes, usually of sheet iron, or other substance, thinner than the bottom plate that descends from it, through the lower flue-space, the same being effected under an arrangement of their respective parts, substantially the same with that described.

2. MODE OF TRIPPING CUT-OFF VALVES; Frederick E. Sickles, City of New York; patented Sept. 19, 1845; extended September 13, 1859.

Claim—Tripping the drop valve of the cut-off by a motion independent of the lifter, in the manner described. Also, combining the wiper that drops the valve of the cut-off, whether working horizontally or vertically, with any of the moving parts of the engine, other than the lifters or their rocking shaft, by means of the sector and arm or arms, by means of which the extent of the cut-off can be regulated at pleasure during the action of the engine, from the full to the least portion of the stroke.

RE-ISSUES.

1. REVOLVING FIRE ARMS; Wm. S. Lavely and James M. Cooper, Assignees of Josiah Ells, Pittsburgh, Penna. patented August 1, 1854; re-issued September 6, 1859.

Claim—1st, The use of a stud in the trigger vibrating laterally, in combination with a bevel-edged hammer, for the purpose of raising the hammer to full cock, and firing the piece by simply pulling the trigger, which, after the discharge of the piece, will regain its position for repeated action, or (as a mere modification of arrangement) the use of a stud in the hammer vibrating laterally, in combination with a bevel-edged trigger, for the purpose specified. 2d, The use of a bevel-edged hammer, with or without a notch in its toe, and trigger with vibrating stud or cam for the trigger spring, for the purpose of causing the hammer, trigger, and revolving breech to assume their proper relative positions at full cock by simply pulling the trigger, and retaining them in that position, and securing the breech from rotation or displacement preparatory to firing. 3d, The notch or depression in the toe of the hammer at the point of contact of the stud and edge of the hammer, in combination with the laterally vibrating stud, for the purpose of preventing the slipping of the stud and the more easy retention of the hammer at the point of full cock. 4th, The mode described of locking the rotating breech at the moment of firing, by means of the locking bolt operated by the trigger, in combination with the hexagonal neck of the rotating breech, which nevertheless permits the breech to be freely rotated by hand or otherwise, when the trigger is not drawn back. 5th, The use of a double trigger spring or spring and lever, for the purpose set forth.

2. ORNAMENTAL CONNEXION OF THE PARTS OF AN IRON FENCE; Henry Jenkins, Cincinnati, Ohio; patented Jan. 30, 1852; re-issued September 6, 1859.

Claim—Forming the ornament or cast iron connexions for a railing, fence, or other article of iron, cast into a divided iron mould, substantially as specified.

3. STRAW CUTTERS; Jacob H. Mumma, Harrisburgh, Pennsylvania; patented January 26, 1858; re-issued September 6, 1859.

Claim—1st, The combined application to straw-cutting machines of a changeable feed gear, with two-edged revolving cutters or blades, when so made that, by changing them end for end on their arms or supports, they shall bring a different cutting edge into action, or when run in either direction, shall always feed in the material in one and the same direction. 2d, The combination of feed rollers acted upon by tappets, and the crushing rollers controlled by gum elastic springs, when arranged in relation to, and acting in connexion with, the cutting apparatus.

4. SEWING MACHINES; John W. Marsh, Oxford, Massachusetts; patented October 27, 1857; re-issued September, 6, 1859.

Claim—1st, The combination of the slide, provided with its guard or its slot or slots with the foot-piece, with its guide and slots, arranged and operating as described. 2d, The combination with the sewing apparatus, or its equivalent, of a movable knife operated by a connexion with the sewing machine, so as to trim or cut the work whilst being sewed, in the manner described.

5. LAMPS; William Fulton, Cranberry, New Jersey; patented August 3, 1858; re-issued Sept. 13, 1859.

Claim—1st, The perforated plate or air distributor, or its equivalent, for the purpose of regulating the elastic force of the air so that it may be presented evenly to the flame (when applied to flat wick lamps), it being placed horizontal. 2d, The perforations in the lower part of the cap, in combination with the perforated or air distributing plate. 3d, The register, formed of the perforations in the top, in combination with the perforated plate or air distributor, and the holes in the lower part of the cap, arranged as described.

6. HEATING ELEVATED OVENS; P. A. Palmer, Troy, New York; patented September 24, 1850; re-issued September 13, 1859.

Claim—The arrangement and combination of reversible flues in elevated ovens of cook stoves, with partition walls, in the manner described. Also, the arrangement and combination of the oven plate, in and with the inner plate and ends of the oven. Also, the arrangement of the damper immediately between the main part of the stove and the bottom or lower part of the elevated oven, thereby combining it with the said oven, the stove, and the double flue, for the purpose of controlling and regulating the heat in its passage into the flues of the said elevated oven, as described, disclaiming any damper found in any stove not having an elevated oven, as set forth.

7. INDIA RUBBER FABRICS; Henry B. Goodyear, Administrator of Nelson Goodyear, deceased, City of New York; patented May 13, 1845; extended for 7 years from May 13, 1859; re-issued September 13, 1859.

Claim—Making fabrics by thoroughly intermingling and incorporating the shearings or clippings of fibrous substances with the gum while rendered plastic by heat, as specified.

8. MACHINE FOR BENDING METAL PIPE; James Perkins and Wm. H. Burnet, Newark, New Jersey; patented October 14, 1856; re-issued September 20, 1859.

Claim—The mandrel, as described, and therewith traversing roller, or its equivalent, for bending coils of metal pipe, and, in combination therewith, the furnace, in the manner set forth.

9. CULTIVATOR TEETH; David B. Rogers, Pittsburgh, Pennsylvania; patented November 1, 1845; re-issued September 20, 1859.

Claim—Making the shank or upper part of cultivator teeth of thin plate-steel, U-shaped or curved round in front, for the purpose of securing the necessary strength to permit the tooth to be made entire, shank and blade of a single piece of metal, and also of enabling the tooth to be secured in its place in the beam by means of a wedge driven into the cavity of the shank.

10. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The arrangement of a cutting apparatus and a reel, with respect to a driving wheel and a grain wheel, or its equivalent, and a raker's seat, or its equivalent, so that the major part of the weight of the cutting apparatus and reel shall be in advance of the axis of oscillation of the machine on the said wheels, while the raker's seat or stand shall be located behind that axis, and the machine, with the raker thereon, nearly balanced on its axis of oscillation.

11. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of a tongue, or its equivalent, to draw the machine by a driving-wheel and gearing arranged at the side of the machine, a short platform, a reel to gather the grain to the platform, and a stand or seat for the raker, fixed upon the machine, so as to enable the raker conveniently to discharge the grain and lay it in gavels upon the ground at the side of the swath, and out of the return path of the horses.

12. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—A seat or stand on the reaping machine for the support of the raker, laterally and in front.

13. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of the reel, the divider, and the raker's seat or stand, co-operating together in such manner that the grain deposited upon the platform and divider may readily be grasped and discharged from the machine by the raker at his seat.

14. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination, in a reaping machine, of the draft and the gearing, arranged at the side of the machine—two compressors, one arranged at each end of the cutter, the short reel to sweep over the space between the compressors and the short platform.

15. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of the grain-guarded platform, to receive and retain the cut grain, with the divider and the reel.

16. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of the reel support at the rear part of the outer side of the platform, with the low flat frame and the divider.

17. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The arrangement of the frame, the finger-beam, and the platform, and the driving-wheel and gearing, relatively to each other, so as to secure an unobstructed gavelling space at the side of the platform, behind the finger-beam.

18. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—A reaping machine frame, consisting, namely, of two principal beams, crossing each other, and arranged relatively to the supporting wheels, so as to give support to a platform not extending behind the gearing, and without interfering with the cutter on one side or the gavelling space on the other.

19. Reaping Machines; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1855; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—1st, A dividing board, having a surface inclined towards the cutter and platform, and an outer dividing line and an inner dividing line, and acting as described. 2d, The combination of the inclined dividing board with a guide bar. 3d, The combination of a reel with the inclined dividing board. 4th, The combination of a reel with the dividing board and guide bar.

20. Magnetic Printing Telegraphs; Royal E. House, Binghampton, New York; patented April 18, 1848; re-issued September 20, 1859.

Claim—1st, A series of keys, each corresponding to a character, in combination with a revolving part of a circuit, so that the touching of one of the former may cause the circuit to be broken or closed for the purpose of printing, when the revolving part of the circuit is in a certain required angular position, properly corresponding to the key struck. 2d, A series of keys, each corresponding to a character, in combination with a revolving portion of a circuit and a shaft provided with pins, arranged in a helix, or the equivalents of the whole, acting to cause the circuit to be broken or closed when the revolving part is in a certain angular position, in proper correspondence with the key struck, for the purpose of printing a proper corresponding letter by means of any suitable machinery. 3d, A key-board or series of keys, in combination with a rotating portion of a circuit and a type-wheel, or its equivalent, so governed as to present a proper letter corresponding with a key touched to produce an impression. 4th, In combination with a single circuit of conductors, a key-board or series of keys, a revolving portion of a circuit, and a type-wheel, and these also in combination with a printing press, and with a key-shaft, or either of them. 5th, A series of keys, each corresponding to a character, in combination with a type-wheel having similar corresponding characters, when so connected by any appropriate devices that a certain type shall be in a certain locality when a corresponding key is actuated—and I claim these two elements, in combination with a single circuit of conductors and with a printing apparatus, or either of them. 6th, Actuating or driving a revolving portion of a circuit or a key-shaft, or both of them, by means of a prime-mover acting upon them through a friction connexion, the mode of operation being substantially as specified, and doing away with sudden jars and increasing rapidity of operation, when contrasted with a positive connexion between such parts and a prime-mover, and also permitting the two to move with varying velocities. 7th, Actuating or driving a key-shaft and a revolving portion of a circuit, or either of them, by means of a friction connexion with a prime-mover, when the velocity of such prime-mover is controlled by a governor, or some equivalent for the purpose, which either prevents its moving too fast or increases its velocity when going too slow, or performs both these duties. 8th, Governing or controlling the motions of a prime-mover, which actuates a printing apparatus by the breaking and closing of an electric or galvanic circuit, so that such apparatus is put in operation by the breaking of a circuit and by the closing thereof—and also the controlling of a printing apparatus, so that it shall be permitted to print

when a spring returns to its normal position at the time that a circuit is broken, the mode of operation being substantially such as set forth. 9th, In a printing telegraph, moving the paper to the types to produce an impression on the former, in the manner described, as distinguished from former modes of operation, by which the types were moved towards the paper. 10th, In combination, a revolving type-wheel and a roller, or its equivalent, charged with coloring matter, so as to deposit such matter on the types as they, in succession, come in contact with the roller—and this I claim also when the roller is grooved. 11th, Being aware of the facts that type-wheels have been permitted to revolve, step by step, when controlled by escapements, and when such escapements have been actuated either by a prime-mover governed by a pendulum, or by electric-magnetic force, I claim actuating an escapement which controls the motions of a type-wheel by a prime-mover, whose motions are regulated by the breaking and closing of a circuit, under a mode of operation such as described, whereby a small force, derivable from magnetism, controls any necessary power of a prime-mover, there being a breaking and closing of a circuit correspondent with each vibration of the escapement. 12th, A hydraulic regulator, such as described. 13th, A hydraulic regulator, in combination with a type-wheel, and a printing apparatus, and a prime-mover, and causes the press to print when the type-wheel ceases to move for a longer time than usual. 14th, In combination with a type-wheel and a printing press or apparatus, I claim apparatus such as specified, for making an alarm when that apparatus is permitted or caused to act by the breaking and closing of the same circuit of conductors, which, by its breaking and closing, permits the printing apparatus to come into action.

21. Machines for Threading Screw Blanks; Elliot Savage, Berlin, Assignor to self and Charles Parker, Meriden, Connecticut; patented Nov. 21, 1854; re-issued September 27, 1859.

Claim—The method described of causing the chasing tool to act upon the screw blank in producing both the cylindrical part and the tapering point, that is to say, by so governing the relative positions of each to the other, that while threading the cylindrical portion the chasing tool shall be presented at a right angle to the axis of rotation of the blank, and while cutting the tapering part shall be so inclined acutely to said axis that the line of travel of the face of the chaser shall finally intersect said axis.

22. Machines for Threading Screw Blanks; Elliot Savage, Berlin, Assignor to self and Charles Parker, Meriden, Connecticut; patented Nov. 21, 1854; re-issued September 27, 1859.

Claim—A wood screw of which the entering end is made to taper, in the manner set forth, that is to say, by giving to the core thereof a form bounded in any plane which passes through the axis of rotation, by lines which converge toward, and if produced, will intersect said axis, in contradistinction to the known form wherein the bounding lines in such planes are parallel to said axis.

23. Waste Device for Hydrants; Joshua Register, Wm. George Webb, J. S. Boche, and John McCart, Assignees of John Calver, Baltimore, Maryland; patented April 22, 1856; re-issued Sept. 27, 1859.

Claim—The described arrangement of the plunger relative to the discharge pipe, and capable of elevation proportioned to the capacity of said pipe by forming a chamber in the lower portion of the hydrant for the reception of the contents of the discharge pipe. Also, in combination, the arrangement of the valve, by means for operating it by the spring.

24. Sewing Machines; Joseph W. Bartlett, City of New York, Assignee of O. L. Reynolds, Dover, N. H.; patented May 14, 1850; re-issued September 27, 1859.

Claim—1st, The employment and use in a sewing or tambouring machine of a needle or thread-carrier, having a movable or flexible beard or hook, and also the combination with the said needle or thread-carrier, of a mechanism for closing the beard thereof. 2d, The combination with a bearded instrument, used as before described, of the thread guide, having the motions described, such as shall carry the thread across the path of the bearded instrument, and present it to the action thereof, without carrying the thread around the shank of the said bearded instrument, in the manner described. 3d, The combination of the cam, lever, and guide, with a spring, whereby the thread is presented to the action of the bearded instrument.

25. Clothes Dryers; Samuel Morrill, Andover, New Hampshire; patented November 14, 1856; re-issued September 27, 1859.

Claim—1st, Tilting the reel to the desired position to enable a person to place the clothes on the lines without high reaching, and elevate them in good position to dry, and out of the way of injury. 2d, Arranging and combining with a rotary tilting reel, the ratchet, and a pawl, or their equivalents, for preventing backward rotary motion of the reel as the clothes are placed on the lines, and moved along. 3d, Operating the reel by the combined action of the arm, jointed arm or lever, and loop or staple, or its equivalent.

26. Mowing Machines; Ephraim Ball, Assignor to Ball & Butler, and Ball & Butler, Assignors to Ephraim Ball, aforesaid, Canton, Ohio; patented December 1, 1857; re-issued September 27, 1859.

Claim—1st, The combination of the short curved arm with the bar and finger bar, arranged for joint operation as set forth. 2d, The combination of the coupling arm with bar, wrist, socket, hinge, and short finger beam, as set forth. 3d, Extending the coupling arm outside of the frame, in combination with the front hinges of bar also outside of the main frame, arranged in the manner described, whereby greater freedom of the movement of the cutting apparatus is secured.

27. Mowing Machines; Ephraim Ball, Assignor to Ball & Butler, and Ball & Butler, Assignors to Ephraim Ball, aforesaid, Canton, Ohio; patented December 1, 1857; re-issued September 27, 1859.

Claim—The combination of the independent driving wheel at the grain side of the machine, with the hinged bar to which the short finger beam is rigidly attached, and the hinged coupling arm, whereby the cutting apparatus may rise and fall freely, and the cutters be kept in operation while turning to the left upon uneven ground.

Designs.

1. Handles of Spoons and Forks; Philo B. Gilbert, City of New York; dated September 6, 1859.
2. Carpet Pattern; Elmira J. Ney, Lowell, Massachusetts, Assignor to the Lowell Manufacturing Company; dated September 6, 1859.
3. Handles of Spoons, Forks, &c.; Henry Hubbard, City of New York; dated September 13, 1859.
4. Skating or Riding-cap for Ladies; Eliza A. Murdock, Boston, Massachusetts; dated September 20, 1859.
5. Cooking Stove; John Martino, Assignor to D. Stuart and J. R. Peterson, Philadelphia, Penna.; dated September 20, 1859.
6. Cylinder Stoves; John Martino and James Horton, Assignors to D Stuart and J. R. Peterson, Philadelphia, Pennsylvania; dated September 20, 1859.
7. Sewing Machine; S. B. Ellithorp, City of New York; dated September 27, 1859.
8. Gas Cocks, &c.; B. M. Johnson, City of New York; dated September 27, 1859.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Details of the Steamer Great Eastern. Collected and estimated by CHAS. H. HASWELL, New York.

Hull built by John Scott Russell & Co. Paddle-wheel engines designed by John Scott Russell and built at Millwall Works. Propeller engines built by James Watt & Co., Soho Works.

HULL.

Length on deck over all,		692 feet.	
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		680 "	
Breadth of beam at midship section,		83 "	
" over paddle-wheel guards,		120 "	
Depth of hold to spar deck,		56 "	3 inches.
" " main deck,		48 "	3 "
" " lower "		41 "	3 "
" " berth "		34 "	3 "
Height from rail to under side of bottom,		62 "	4 "
Length of engine and boiler space, under lower deck,		350 "	
Tonnage,	22,500.		

*WATER-WHEEL ENGINES.

Description—Oscillating.

" of Boilers—Horizontal tubular—furnaces at each end—one smoke-pipe in common for each set of two.

Diameter of cylinders, four of			74 inches.
Length of stroke,		14 feet.	
Diameter of water-wheels,		56 "	
Length of blades,		13 "	
Depth "		3 "	
Number "	thirty.		
" of boilers,	four.		
Length "		17 "	6 "
Breadth "		17 "	9 "
Height "		13 "	6 "
Number of furnaces (five at each end),	ten.		
Width "		2 "	11 "
Length of grate bars,		7 "	
Number of tubes,	3200.		
Diameter " external,			3 "
Thickness "	No. 12 wire gauge.		
Length "		5 "	4 "
Diameter of smoke-pipe,		5 "	10 "
Height "		86 "	
Area of grate surface,		370 "	
Heating surface, tubes alone,		17,600 "	
Thickness of plates, Sides, 3/8.	Bottom,	7-16. inches.	
Front tubes, 1/2.	Back tubes,	9-16. "	
Maximum pressure of steam *in pounds*,	25.		
" revolutions *per minute*,	16.		
Point of cutting off,	one-fourth.		
Weight of boilers, *without water*, each	51 tons.		
" water,	39 "		

* The term "water-wheel" is according to the author's copy.

PROPELLER ENGINES.

Description.—Horizontal direct-acting.
" of boilers.—Same design as those for the water-wheel engines.

Diameter of cylinders,				84 inches
Length of stroke,		4 feet.		
Diameter of propeller,		24 "		
Pitch "		44 "		
Number of blades,	ten.			
" boilers,	six.			
Length "		17 "	6 "	
Breadth "		18 "	4 "	
Height "		13 "	10 "	
Number of furnaces (six at each end),	twelve.			
Width "		2 "	5 "	
Length of grate bars,		7 "	6 "	
Number of tubes,	4920			
Diameter " external,			3 "	
Thickness "	No. 10 wire gauge.			
Length "		5 "	6 "	
Diameter of smoke-pipes, (three,)		6 "		
Height "		86 "		
Area of grate surface,		406 "		
Heating surface, tubes alone,		27,300 "		
Thickness of plates, Sides, 7-16. Bottom,		½ inch.		
Front tubes, ½. Back tubes,		⅝ "		
Maximum pressure of steam *in pounds*,	25.			
" revolutions *per minute*,	55.			
Point of cutting off,	one-fourth.			
Weight of engines and boilers,	1500 tons.			
" boilers, *without water*, each,	55 "			
" water, each,	45 "			
Capacity of coal bunkers, in tons of coal,	12,000 "			
Consumption of coal per hour, estimated,	10 "			
Draft of water at load line,		30 feet.		
" " light "		20 "		
Area of immersed midship section at light draft of 20 feet,		1360 sq. ft.		
" " load " 30 "		2180 "		

HULL.—Frame of wrought iron plates. Bottom doubled at an interval of 2 feet 10 inches, to a height of 39 feet from under side. Outer and inner plates ¾ of an inch thick—connected, fore and aft, by 36 fore and aft webs, ½ an inch thick —2½ feet apart at side of keel, and running to 4½ feet at top of sides, crosswise by webs every 10 feet. These webs are secured to the outer and inner plates by angle iron.

Description of coal, . . Bituminous and Anthracite.

Details and Remarks.—Four decks. Spar deck, 2 feet 5 ins. deep. Ten water-tight athwartship bulkheads. Two transverse bulkheads for 350 feet. Launching draft, 14 feet 6 ins.; displacement equal to 10,500 tons.

Each pair of cylinders of water-wheel engines is arranged to be detached from the other by a friction clutch, and each cylinder can be detached from connexion with the other.

All surfaces of cylinders, steam-chests, and steam-pipes are jacketed and heated by steam from an auxiliary boiler.

Estimated power, water-wheel engines at 11 revolutions per minute and 15 lbs. pressure. Cut-off at ⅓. 3000 horses; at 16 revolutions and 25 lbs. Cut-off at ¼. 5000 horses. Propeller engines at 42 revolutions and 16 lbs. pressure. Cut-off at ¾. 5000 horses.

Boilers proved with a cold pressure of 50 lbs. Each set of boilers has an independent steam engine (donkey). There are two auxiliary engines for hoisting, pumping, &c. Area of canvass, 6500 square yards. Chains, cables, $2\frac{7}{8}$ inches diameter. Anchors, chains, and capstans, 250 tons.

Weight of propeller, . .	36 tons.
" " shaft, .	60 "
" rudder stock (18 ins. diameter),	22 "

Two propeller steamers swung at sides, abaft of wheel-house, of 120 tons burthen each.

Accommodation.—1st class passengers, 800. 2d class passengers, 2000. 3d class passengers, 1200.

Result of trial trip.—Draft of water, forward 22 feet 2 ins.; aft, 25 feet—mean, 23 feet 7 inches.

Water-wheel engines: pressure of steam, 15·5 lbs. Cut-off at $\frac{4}{11}$ lbs. of stroke. 11 to 11·5 revolutions. Indicated power, 3330 horses.

Propeller engines: pressure of steam 16 lbs. Cut-off at $\frac{3}{4}$ of stroke. 41 revolutions. Indicated power, 4800 horses.

Speed: with jib and fore spankers set, having an area of canvass of 2500 yards, 14·5 knots.

Consumption of fuel: 3·5 lbs. per horse power per hour.

For the Journal of the Franklin Institute.

Particulars of the Steamer Adriatic.

This steamer having lately been purchased by the North Atlantic Steamship Company, is being fitted for sea, and at the same time her accommodations for passengers have been so altered as to meet the requirements of the new and particular service for which she is intended.

The essential modification regarding the hull is the addition of a deck extending to the line of her rail, but not enclosed at the sides beyond the line of saloon, officers' state rooms, &c. Regarding the engines, an alteration in the operation of the valves is being made by the Novelty Iron Works—a trial of the engine will be made very shortly, and so soon as approved of she will be put upon the route between New York and Aspinwall.

Hull built by James and George Steers. Machinery by Novelty Iron Works, New York.

Hull.—

Length over all, . . .	351 feet 8 inches.
Length on deck, from fore part of stem to after part of stern post, above the spar deck, . .	344 " 6 "
" at load line, . . .	343 " 10 "
Breadth of beam at midship section, *molded*, .	48 " 8 "
" " " *extreme*, .	50 "
Depth of hold, . . .	25 "
" to spar deck, . .	33 " 2 "
Length of engine and boiler space, including side bunkers,	130 "
Tonnage, custom-house, . .	4144.

Engines.—Description of engines—Oscillating.

Diameter of cylinders,			101 inches.
Length of stroke,		12 feet.	
Maximum pressure of steam in pounds,	26.		
" revolutions per minute,	14.		
Point of cutting-off,	one-half.		
Draft of water at above pressure and revolutions,		18 "	6 "
Area of immersed midship section at load draft,		880 "	
Diameter of paddle-wheels,		40 "	
Length of blades,		12 "	
Depth "		3 "	
Number "	32.		
Area of blade surface,		2144 "	

Boilers.—Description of boilers—Vertical tubular.

Number of boilers,	8.		
Length "		20 feet	$1\frac{1}{2}$ inches.
Breadth "		11 "	3 "
Height " exclusive of steam chimney,		14 "	
Number of furnaces,	48.		
Width "		2 "	9 "
Length of grate bars,		8 "	
Number of tubes,	13,064.		
Diameter " external,			2 "
Length "		8 "	
Diameter of smoke pipes, (two,)		7 "	
Height "		40 "	
Heating surface (fire and flues),	30,758 sq. ft.		
Combustion,	Natural draft.		
Capacity of coal bunkers, in tons of coal,	1200.		
Consumption of coal per hour,	4 tons.		
Draft of water at load line,		20 "	
" " light "		17 "	$1\frac{1}{2}$ "
Displacement " "	5233 tons.		
Weight of engines, *in pounds*,	825,000.		
" boilers, without water,	836,232.		
" water in boilers,	1,075,200.		
Floor timbers at throats, *molded*,			22 "
" " *sided*,			13 and 16 "
Distance of frames *apart at centres*,			33 and 36 "
Frame strapped with diagonal and double laid iron straps,			$\frac{5}{8}$ by 5 "
Masts and rig—Brig.			
Intended service,	New York to Aspinwall.		
Description of coal,	Anthracite or Bituminous.		

Memoranda.—Launching draft, 10 feet 2 ins. Weight of hull, 2041 tons. Weight of engines, boilers, water, coal, spars, &c., 2400 tons.

Average displacement per inch from launching draft to light load line (17 feet $1\frac{1}{2}$ ins.), 26·43 tons. Average displacement per inch from light load line to load line (20 feet), 28·75 tons. Average displacement per inch from load line to 21 feet 6 ins., 31·5 tons.

Piston rod 14 inches in diameter. Shafts 26·5 inches in diameter. Air-pump 42 inches in diameter by 5 feet stroke of piston. Condensers, Pirsson's fresh water, having 24,000 square feet of surface. Diameter of tubes, $\frac{3}{4}$-inch, of No. 17 wire gauge.

Accommodations—Cabin passengers, 350; 2d cabin, 200; Steerage passengers, 1000. Freight, 800 tons measurement. C. H. H.

*On the Manufacture of Malleable Iron and Steel.**
By Mr. Henry Bessemer.

[From a Paper read before the Institution of Civil Engineers, London.]

Attention was directed, in the early part of the Paper, to the ordinary mode of manufacturing iron by the puddling process; in the course of which the iron, after it "came to nature," was gathered into balls, and was then removed, as quickly as possible, to the squeezer, where much of the fluid scoria, with other mechanically mixed impurities, was driven out, leaving a mass or billet of iron, composed of thousands of separate fragments of metal, the entire surface of every one of which was, more or less, coated with dry oxide, or fluid silicate of the oxide of iron. The great pressure exerted by the squeezer sufficed to so far remove the fluid coating of the contiguous particles as to bring their surfaces into actual contact, and consequently to effect an union at such parts. But the whole of the matter thus displaced could not find its way between the interstices of the mass, and therefore it became locked in its numerous cavities, producing points of weakness and separation in the metal. No amount of after working, or rolling, could wholly displace the portions of cinder, dry oxide of iron, and of sand, which thus became mixed up with and were diffused throughout the mass, causing flaws and cracks in the iron, all, more or less, objectionable.

Now, if these imperfections were the natural and inevitable consequences of the conditions under which malleable iron was at present produced, it followed that defects of a similar character must also of necessity exist in steel, produced by the puddling process. The granular condition of the metal and its exposure to heat and oxygen, could not fail, in both cases, to oxidize the entire surfaces of the numerous molecules to be united into one mass; the admixture of scoria and other matters, from the furnace, was equally certain to result; and also the difficulty of bringing each particle of the metal to the same degree of decarbonization and refinement existed as in the making of iron, with the additional inconvenience arising from some portions of the metal becoming entirely decarbonized, and being converted into soft malleable iron.

Iron thus presented a most unfavorable contrast with the other malleable metals, all of which were free from sand or scoria; they had no hard and soft parts, and required no welding together of separate molecules, but they were perfectly homogeneous, and free from all mechanical admixture with foreign substances. Gold, silver, copper, zinc, tin, and lead, owed this valuable exemption from the defects universally found in puddled iron, simply to the fact that they were purified and refined in a fluid state, and while still fluid were formed into ingots, whereby the cohesion of every particle in the mass was insured. If, then, the refining of other malleable metals, while in a fluid state, and their formation into cast ingots, rendered all such metals more sound and homogeneous than iron, while it did not lessen their extreme ductility, why should iron for ever remain an exception to the general

* From the Lond. Artizan, July, 1859.

rule? It might be truly answered, that hitherto the excessively high temperature required to fuse and to maintain pure iron in a fluid state, had interposed an insuperable barrier, for the highest heat of the furnaces only sufficed to show that fluidity was a possible condition of that metal.

It need not, therefore, be a matter of surprise, that when Mr. Bessemer first proposed to convert crude pig iron into malleable iron, while in a fluid state, and to retain the fluidity of the metal, for a sufficient time to admit of its being cast into moulds, without the employment of any fuel in the process, his proposition was looked upon by many as a chimera, or as the mere day dream of an enthusiast; but it was nevertheless fully recognised and supported by many of the scientific men of the day. The same deep conviction of the truth on which the new process was based, and which led Mr. Bessemer to bring it before the British Association, in 1856, had since determined him (in spite of the opinions then pronounced against the process) to pursue one undeviating course until the present time, and to remain silent for years, under the expressed doubts of those who predicted its failure, rather than again bring forward the invention until it had been practically and commercially worked; and there had been produced by it both iron and steel, of a quality which could not be surpassed by any iron or steel made by the tedious and expensive process now in general use.

The want of success which attended some of the early experiments was erroneously attributed, by some persons, to the "burning" of the metal, and by others to the absence of cinder, and to the crystalline condition of cast metal. It was almost needless to say, that neither of the causes assigned had any thing to do with the failure of the process, in those cases where failure had occurred. Chemical investigation soon pointed out the real source of difficulty. It was found that, although the metal could be wholly decarbonized, and the silicum be removed, the quantity of sulphur and of phosphorus was but little affected; and as different samples were carefully analyzed, it was ascertained that red shortness was always produced by sulphur, when present to the extent of $\frac{1}{10}$th per cent., and that cold shortness resulted from the presence of a like quantity of phosphorus; it, therefore, became necessary to remove those substances. Steam and pure hydrogen gas were tried, with more or less success, in the removal of sulphur, and various fluxes, composed chiefly of silicates of the oxide of iron and manganese, were brought in contact with the fluid metal, during the process, and the quantity of phosphorus was thereby reduced. Thus many months were consumed in laborious and expensive experiments; consecutive steps in advance were made, and many valuable facts were elicited. The successful working of some of the higher qualities of pig iron caused a total change in the process, to which the efforts of Messrs. Bessemer and Longsdon were directed. It was determined to import some of the best Swedish pig iron, from which steel of excellent quality was made, and tried for almost all the uses for which steel of the highest class was employed. It was then decided to discontinue, for a time, all fur-

ther experiments, and to erect steel works at Sheffield, for the express purpose of fully developing and working the new process commercially, and thus to remove the erroneous impressions so generally entertained in reference to the Bessemer process.

In manufacturing tool steel of the highest quality it was found preferable, for several reasons, to use the best of Swedish pig iron, and, when converted into steel by the Bessemer process, to pour the fluid steel into water, and afterwards to re-melt the shotted metal in a crucible, as at present practised in making blister steel, whereby the small ingots required for this particular article were more perfectly and more readily made.

It was satisfactory to know that there existed in this country vast, and, apparently, inexhaustible beds of the purest ores, fitted for the process. Of the hematite alone, 970,000 tons were raised annually, and this quantity might be doubled or trebled, whenever a demand arose. It was from the hematite pig iron, made at the Workington Iron Works, that most of the larger samples of iron and steel exhibited were made. About 1 ton 13 cwt. of ore, costing 10s. per ton, would yield 1 ton of pig metal, with 60 per cent. less lime, and 20 per cent. less fuel, than were generally consumed when working inferior ores; while the furnaces using this ore alone yielded from 220 to 240 tons per week, instead of, say 160 to 180 tons per week when working with common iron-stone. The Cleator Moor, the Weardale, and the Forest of Dean Iron Works, also produced an excellent metal for this purpose.

The form of converting-vessel, which had been found most suitable, somewhat resembled the glass retort used by chemists for distillation. It was mounted on axes, and was lined with "ganister," or road drift, which lasted during the conversion of thirty or forty charges of steel, and was then quickly and cheaply repaired or renewed. The vessel was brought into an inclined position, to receive the charge of crude iron, during which time the tuyeres were above the surface of the metal. As soon as the whole charge was run in, the vessel was moved on its axes, so as to bring the tuyeres below the level of the metal, when the process was at once brought into full activity, and twenty small, though powerful jets of air sprung upwards through the fluid mass; the air expanding in volume, divided itself into globules, or burst violently upwards, carrying with it a large quantity of the fluid metal, which again fell back into the burning mass below.

The oxygen of the air, appeared in this process, first to produce the combustion of the carbon contained in the iron, and at the same time to oxidize the silicum, producing silicic acid, which uniting with the oxide of iron, obtained by the cumbustion of a small quantity of metallic iron, thus produced a fluid silicate of the oxide of iron or "cinder," which was retained in the vessel, and assisted in purifying the metal. The increase of temperature which the metal underwent, and which seemed so disproportionate to the quantity of carbon and iron consumed, was doubtless owing to the favorable circumstances under which combustion took place. There was no intercepting material to

absorb the heat generated, and to prevent its being taken up by the metal, for heat was evolved at thousands of points, distributed throughout the fluid, and when the metal boiled, the whole mass rose far above its natural level, forming a sort of spongy froth, with an intensely vivid combustion going on in every one of its numberless, ever-changing cavities. Thus, by the mere action of the blast, a temperature was attained in the largest masses of metal, in ten or twelve minutes, that whole days of exposure in the most powerful furnace would fail to produce.

The amount of decarbonization of the metal was regulated, with great accuracy, by a metre, which indicated on a dial the number of cubic feet of air that had passed through the metal; so that steel of any quality or temper could be obtained with the greatest certainty. As soon as the metal had reached the desired point (as indicated by the dial), the workmen moved the vessel, so as to pour out the fluid malleable iron, or steel, into a founder's ladle, which was attached to the arm of a hydraulic crane, so as to be brought readily over the moulds. The ladle was provided with a fire-clay plug at the bottom, the raising of which, by a suitable lever, allowed the fluid metal to descend in a clear vertical stream into the moulds. When the first mould was filled, the plug valve was depressed, and the metal was prevented from flowing until the casting ladle was moved over the next mould, when the raising of the plug allowed this to be filled in a similar manner, and so on, until all the moulds were filled.

The casting of large masses of a perfectly homogeneous malleable metal into any desired form rendered unnecessary the tedious, expensive, and uncertain operation of welding now employed wherever large masses were required. The extreme toughness and extensibility of the Bessemer iron was proved by the bending of cold bars of iron, 3 ins. square, under the hammer into a close fold, without the smallest perceptible rupture of the metal at any part; the bar being extended on the outside of the bend from 12 inches to 16¾ inches, and being compressed on the inside from 12 inches to 7¼ ins., making a difference in length of 9½ ins. between what, before bending, were the two parallel sides of a bar 3 ins. square. An iron cable, consisting of four strands of round iron, 1½ ins. diameter, was so closely twisted, while cold, as to cause the strands at the point of contact to be permanently imbedded into each other. Each of these strands had elongated 12½ inches in a length of 4 ft., and had diminished one-tenth of an inch in diameter, throughout their whole length. There were also exhibited some steel bars, 2 ins. square, and 2 ft. 6 ins. in length, twisted cold into a spiral, the angles of which were about 45 degrees; and some round steel bars, 2 ins. in diameter, bent cold under the hammer, into the form of an ordinary horse-shoe magnet, the outside of the bend measuring 5 ins. more than the inside.

The steel and iron boiler plates, left without shearing, and with their ends bent over cold, also afforded ample evidence of the extreme tenacity and toughness of the metal; while the clear even surface of the railway axle and piece of malleable iron ordnance were examples

of the perfect freedom from cracks, flaws, or hard veins, which formed so distinguishing a characteristic of the new metal. The tensile strength of this metal was not less remarkable, as the several samples of steel tested in the proving-machine, at Woolwich Arsenal, bore, according to the reports of Colonel Eardley-Wilmot, R. A., a strain varying from 150,000 lbs. to 162,000 lbs. on the square inch, and four samples of iron boiler-plate from 68,314 lbs. to 73,100 lbs; while, according to the published experiments of Mr. W. Fairbairn, Staffordshire plates bore a mean strain of 45,000 lbs., and Low Moor and Bowling plates, a mean of 57,120 lbs. per square inch.

There was also another fact of great importance in a commercial point of view. In the manufacture of plates for boilers and for ship-building, the cost of production increased considerably with the increase of weight in the plate; for instance, the Low Moor Iron Company demanded £22 per ton for plates weighing 2½ cwt. each, but if the weight exceeded 5 cwt., then the price rose from £22 to £37 per ton. Now, with cast ingots, such as the one exhibited, and from which the sample plates were made, it was less troublesome, less expensive, and less wasteful of material, to make plates weighing from 10 to 20 cwt. than to produce smaller ones, and indeed there could be but little doubt that large plates would eventually be made in preference, and that those who wanted small plates would have to cut them from the large ones. A moment's reflection would therefore show the great economy of the new process, in this respect; and when it was remembered that every riveted joint in a plate reduced the ultimate strength of each 100 lbs. to 70 lbs., the great value of long plates for girders and for ship-building would be fully appreciated.

At a time when the manufacture of ordnance occupied so large a share of public attention, it was interesting briefly to point out the great facility which the Bessemer process afforded of forming masses, both of malleable iron and of steel, of a size suitable for the heaviest ordnance, without any welding together of separate slabs, or the more costlier mode of building up the gun with pieces accurately turned and fitted together. Many attempts have been made to produce wrought iron ordnance, and this object had been successfully accomplished in the case of the large gun produced at the Mersey forge. But, however perfect this one gun might be, the time required to make it, and its immense cost, manifestly rendered it still a great desideratum to produce guns rapidly and cheaply of a material equal to or greater in tensile strength than wrought iron, and, if possible, free from the liability which that material had to flaws and to deterioration, during its long exposure to a welding heat. It was believed that the Bessemer process supplied this desideratum, as masses of cast malleable metal could be produced of 10 to 20 tons in weight in a single piece, and two or three such pieces might be conveniently made by the same apparatus in one day. The metal so made might be either soft malleable iron or soft steel. In order to prove the extreme toughness of such iron, and the strain to which it might be subjected without bursting, several cast and hammered cylinders were placed cold under the steam-hammer,

and were crushed down without the least tearing of the metal, as was shown by the samples exhibited. These cylinders were drawn from a round cast iron ingot of only 2 ins. greater diameter than the finished cylinder, and in the precise way in which a gun would be treated; they might, therefore, be considered as short sections of an ordinary 9-pounder field-piece. The tensile strength of the samples, as tested at the Royal Arsenal, was 64,566 lbs. per sq. in., while the tensile strength of pieces cut from the Mersey gun gave a mean of 50,624 lbs. longitudinally, and 43,339 lbs. across the grain; thus showing a mean of 17,550 lbs. per sq. in. in favor of the Bessemer iron.

If it was desired to produce ordnance by merely casting the metal, the ordinary founding process might be employed with the simple difference, that the iron, instead of running direct from the melting furnace into the mould, must first be run into the converting vessel, where in ten minutes it would become steel, or malleable iron, as was desired, and the casting might then take place as in the ordinary manner. The small piece of ordnance exhibited served to illustrate this important manufacture; and it was interesting, in consequence of its being the first gun that was ever made in malleable iron without a weld or joint. The importance of this fact would be enhanced when it was known that conical masses of this pure tough metal, of from 5 to 10 tons in weight, could be produced at Woolwich at a cost not exceeding £6 12s. per ton, inclusive of the cost of pig iron, remelting, waste in the process, labor, and engine power. The conical ingots being cast in iron moulds, the great delay in moulding in loam would be avoided; and as the iron moulds employed might be removed from the casting-pit within an hour after the metal had been poured into them, the tedious interval of three days now required by the cast iron guns before removal would be also avoided, thus immensely increasing the capabilities of the foundry.

If it was assumed that these advantages were about equal to the cost of hammering the cast ingot, then, by this process, it would be practicable to produce guns of any size, in hammered cast steel, or malleable iron, ready for the boring mill, at about the same cost as the cast iron guns now in use; but if the weight of the guns could be reduced by 20 or 25 per cent., in consequence of their superior strength, then an actual saving in that proportion would be effected in the first cost of every gun so made. These important facts had been laid before the government, and their advantages were stated to be fully appreciated by Colonel Eardley-Wilmot, the Superintendent of the Royal Gun Factories, who had evinced a great interest in the progress of the invention from its earliest date, and to whose kindness the author was indebted for the many valuable trials of the tensile strength of the various samples of metal that have been submitted for investigation.

It would be interesting to those who were watching the advancement of the new process to know that it was already rapidly extending itself over Europe. The firm of Daniel Elfstrand & Co., of Edsken, who were the pioneers in Sweden, had now made several hundred tons of excellent steel by Bessemer's process. Another large manufactory had

since been started in their immediate neighborhood, and three other companies were also making arrangements to use the process. The authorities in Sweden had fully investigated the whole process, and had pronounced in favor of it. The large steel circular saw plate exhibited was made by Mr. Göranson, of Geffle, in Sweden, the ingot being cast direct from the fluid metal, within fifteen minutes of its leaving the blast furnace. In France, the process has been for some time carried on by the old established firm of James Jackson & Son, at their steel works, near Bordeaux. This firm was about to manufacture puddled steel on a large scale. They had already got a puddling furnace erected and in active operation, when their attention was directed to the Bessemer process, the apparatus for which was put up at their works last year; and they were now extending their field of operations by putting up more powerful apparatus at the blast furnaces in the Landes. There were also four other blast furnaces in the south of France in course of erection, for the express purpose of carrying out the new process.

The irons of Algeria and Saxony had produced steel of the highest quality.

Belgium was not much behind her neighbors; the process was now being carried into operation at Liege, where excellent steel had been made from the native coke iron; while in Sardinia preparations were also being made for working the system. Russia had sent to London an engineer and a professor of chemistry to report on the process, and Professor Müller, of Vienna, and M. Dumas and others from Paris, had visited Sweden, to inspect and report on the working of the new system in that country.

The Bessemer process might therefore be now fairly considered an accomplished commercial fact, and in a country like England, where the manufacture of iron and steel formed so important a branch of the national industry, and was so necessary an element in all the great manufacturing operations, it must be admitted that an impartial examination of the new system was of the highest importance, not only to those immediately concerned in the production of malleable iron and steel, but to the country generally.

That the process admitted of further improvement, and of a vast extension beyond its present limits, the author had no doubt; but those steps in advance would, he imagined, result chiefly from the experience gained in the daily commercial working of the process, and would most probably be the contributions of the many practical men who might be engaged in carrying on the manufacture of iron and steel by this system. Hitherto the process had been brought into its present practical and commercial state, without recourse to any of the numerous inventions which were supposed by the several authors to be essential to the success of the system; but any real improvement that might be brought forward would be cordially received and encouraged.

*Jensen's Marine Engine Governor.**

At the Institution of Mechanical Engineers, on Wednesday, the 4th of May, a paper was read by Mr. Henry Maudslay, descriptive of this apparatus, the object of which is to prevent the engine from running off at an excessive speed, when the resistance of the water is suddenly removed by the pitching or rolling motion of the vessel in stormy weather. This governor consists of a cylinder, A, at the bottom of which a communication or opening, B, is made through the side of the vessel, as near as possible to the propeller or paddle wheel; in this

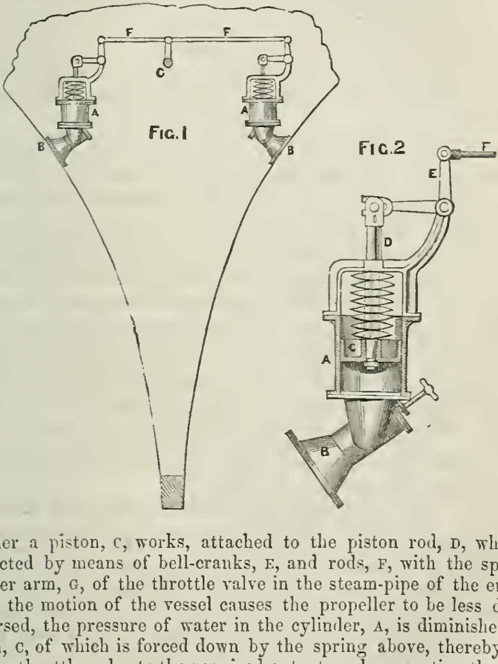

Fig. 1

Fig. 2

cylinder a piston, C, works, attached to the piston rod, D, which is connected by means of bell-cranks, E, and rods, F, with the spanner or lever arm, G, of the throttle valve in the steam-pipe of the engine. When the motion of the vessel causes the propeller to be less deeply immersed, the pressure of water in the cylinder, A, is diminished, the piston, C, of which is forced down by the spring above, thereby closing the throttle valve to the required extent, and preventing the speed of the engine from increasing; also, when the propeller is more deeply immersed, the pressure in the cylinder, A, is increased, and raises the piston, C, opening the throttle valve, and admitting more steam to the engine, so as to maintain the required speed: the object being to control the speed of the engine before it has time to sensibly change,

* From the Lond. Artizan, June, 1859.

instead of waiting for a change to bring the governor into action. Fig. 1 is a view of the apparatus as applied to a vessel; the apparatus is shown in Fig. 2 detached and to an enlarged scale.

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*The Origin of the Electric Telegraph.**

Dr. Hamel, of the Imperial Academy of Sciences at St. Petersburg, who has communicated to that Academy the results of his laborious researches regarding the early history of the Electric Telegraph, shows how the construction of the very first telegraph, worked by a galvanic battery, originated.

On the 6th of August of this year, it will be just half a century since it was completed at Munich, in Bavaria. It appears that an event in connexion with the war brought on by Austria against France fifty years ago, in 1809, caused the galvanic telegraph to be invented and made.

The Austrian army had on the 9th of April in that year begun to cross the river Inn, and to enter Bavaria. King Maximilian had hardly been informed of this, when he, on the 11th, with his family, in all haste, retired from Munich to the western frontier of his kingdom, to the town of Dillingen.

He took with him Baron von Montgelas, who was at the head of two of the most important branches of administration in Bavaria, the Foreign and Home Departments.

By means of the line of Chappe's optico-mechanical telegraphs, established all the way from the French frontier to Paris, the Emperor Napoleon I. got there the information of the Austrian army having entered Bavaria much sooner than it had been thought possible by the Bavarians, namely on the 12th, and he, without delay, departed from Paris for Bavaria on the way to his army. He came so totally unexpected to Dillingen, that he found King Maximilian in bed.

There is no doubt that, to the speedy arrival of the Emperor Napolean I. in the midst of his army, Bavaria owed its deliverance from the Austrians. Munich had been already, on the 16th of April, occupied by the Austrian General Jellachich, but he was in less than a week after, on the 22d, obliged to withdraw, and King Maximilian was again able to enter into his capital.

This event, so vitally important for Bavaria and Munich, must there have directed a special attention to the utility of telegraphs.

Baron Montgelas had been witness of the surprise caused by the French Emperor's unexpected arrival at Dillingen. Under his extensive administration was also the Munich Academy of Sciences. Dr. Samuel Thomas von Soemmerring, the well known anatomist and physiologist, who had been since 1805 a member of that Academy, was from time to time invited to come to dine with the minister Montgelas at Bogenhausen, near Munich, where he lived. This was the case on the 5th of July, 1809, when the minister expressed to him the wish to

* From the Journal of the Society of Arts, No. 338.

get from the Academy of Sciences proposals for telegraphs, having, it is to be supposed, in view no other but improved optical or mechanical telegraphs.

Soemmerring, who had, like Humboldt, very early paid attention to galvanism, in hopes of being able to make its study useful to clear up some of the most mysterious portions of physiology, and who also had now closely followed and noted the brilliant chemical discoveries made by Davy with the galvanic battery in the laboratory of the Royal Institution in London, at once resolved to try whether the evolution of gases from the decomposition of water by the action of the galvanic current might not be applied to telegraphic purposes.

From the time of the above mentioned dinner at the minister's, he gave himself no rest in his endeavors to construct a galvano-chemical telegraph.

On the 6th of August he considered the object of his ardent desire attained. He noted that day: "Tried the entirely finished instrument, which completely answers my expectations." He was then able to work with the telegraph he had invented through 724 feet of wire. Twelve days later he telegraphed through no less than 2000 feet, and on the 29th of August, he exhibited his telegraph in action before a meeting of the Academy of Sciences.

He now wished to send his instrument to the National Institute in Paris. On the 4th of November, the chief surgeon of the French army, Dominique Jean Larrey, with whom Soemmerring had been long acquainted, came to Munich on his way to Paris from the army, after the battles of Aspern, Esslingen, and particularly at Deutsch Wagram, where Napoleon I. had on the field created him a Baron. Larrey most readily offered to take the telegraph with him, and even assisted at the packing of it.

After his departure, Soemmerring composed a French memoir, describing his invention, which he forwarded to Larrey, in Paris, with a letter, wherein he expressed his hope that he would also exhibit the telegraph to the Emperor.

Dr. Hamel has ascertained in Paris, that Larrey presented Soemmerring's telegraph to the Institute on the 4th of December (1809), and that Biot, Carnot, Charles and Monge were appointed to report on it.

Soemmerring to his great delight, succeeded in accomplishing on the 23d of August, 1810, his very ingenious mechanical contrivance for causing the gas bubbles rising from the wire-points in the water to ring an alarm bell.

Ten days previous to that, on the 13th of August, Baron Schilling, then attached to the Russian Mission at Munich, saw for the first time Soemmerring's telegraph. He became enthusiastically fond of the new art of signalizing, which promised to become so all-important, and he directed the attention of many other persons to it. In 1811 he introduced to Soemmerring, Colonel Count Jeroslas Potocky, who took a telegraph made for him to Vienna, and exhibited it on the 1st of July to the Emperor Francis I., in the presence of the Empress and

the Archdukes Charles and John. His Majesty expressed the wish to have a telegraphic communication established between Vienna, and his country palace Laxenburg, a distance of nine miles. Baron Schilling was, as stated in the *Journal* a short time since,* the medium by which the British Envoy and Minister Plenipotentiary at Munich, the Honorable Frederic James Lamb, brother to Lady Palmerston, and subsequently the second Lord Melbourne, on the 12th of July, 1816, witnessed experiments with Soemmerring's instrument, being the first Englishman who ever saw a galvanic telegraph.

Again, Baron Schilling was the person who, at a later period, made in St. Petersburg the first electro-magnetic telegraph, which he, in 1835, two years before his death, exhibited to the meeting of the German naturalists at Bonn. Dr Hamel has explained to the St. Petersburg Academy, in detail, how Baron Schilling's telegraphic contrivance found, in 1836, its way from the borders of the Rhine to England, and so gave the impulse to the spreading of that most wonderful application of science, by means of which, ere long, all inhabited parts of the globe will be put in telegraphic intercommunication.

* Journal of the Society of Arts, Vol. VII, p. 235.

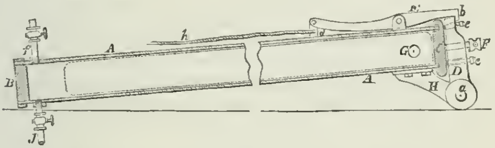
An improved method of effecting the separation of the fibres of wood, for the manufacture of paper therefrom, which is also applicable to the separation of the fibres of flax or other substances for the manufacture of textile fabrics, and also to the separation of other substances for similar or other purposes,—being a Communication. Patented by William Edward Newton.* Dated London, June 21st, 1858.

It is well known that the fibres of most kinds of wood are arranged in the form of very minute tubes, in which the sap circulates. Now the improved method of separating these fibres, constituting this invention, consists in subjecting the wood, while in a strong cylinder or box, to the action of steam, air, gas, hot water, or other fluid, under a high pressure, for the purpose of charging its tubes, as well as the spaces between them, and then causing it to be suddenly projected from the cylinder or box into the atmosphere or into a partial vacuum, where, by the expansive force acting within and upon the tubes, they will burst open, and cause the complete separation of the fibres. The same process applies to the separation and opening of flax and other analogous fibrous materials.

The figure exhibits a longitudinal central section of a cylinder, or, as (from its operation) it may be termed, a gun, for effecting the separation of the fibres of wood preparatory to their conversion into paper pulp. This gun may be of any suitable length and calibre, and composed of a piece or pieces of lap-welded iron tubing A, permanently closed at one end with a stopper B, and at the other end fitted with a movable head or cap C. The cap is to be fitted after the fashion of a valve, or with a suitable packing to be capable of making a steam-

* From Newton's London Journal, April, 1859.

tight joint. In order to secure this cap C, firmly in place, and thereby close the gun, a bracket-arm H, is bolted to one side of the gun, for the purpose of carrying by a hinge-joint *a*, a strong lever D, which is capable of being brought to a position across the cap C, and secured in that position by a hook *b*, at one end of the lever E, which is attached to the gun on the opposite side to that of the hinge-joint *a*, of the first lever by a fulcrum pin *c*. The other end of the lever E has hinged to it a prop piece *d*, which, when resting upon the side of the gun, secures the hook *b*, upon the lever D. F, is a screw, working in the lever D, for the purpose of securing the cap closely to the mouth or muzzle of the gun; and *e*, *e*, are screw-bolts, which attach the cap loosely to the lever D. G, is a steam-pipe, for admitting steam from a boiler to the gun next the cap C. This pipe should be furnished with a stop-cock or valve. *f*, is the pipe at the other end of the gun, for the escape of air when the steam is admitted. *j*, is a pipe, for allowing any water to run back from the gun to the boiler when desired.—This gun is to be placed in a slightly inclined position, so that a small



quantity of water may settle near the breech, and should either be mounted in a very strong frame, capable of sustaining it against recoil, or be otherwise supported at its breech for that purpose. The wood may be put in. either in the form of a log, as large as can be conveniently inserted, or in smaller pieces, and in any case the gun may be nearly filled with it, provided that a space be left near the breech for the collection of a small quantity of water. It is better that the wood should be cut while green, and, before being put in the gun, it should be soaked in water for several days, or till the sap is displaced by the water. When the wood has been put in, the lever D, is brought up and secured by bringing down the hook *b*, of the lever E, upon it, and by setting up the prop piece *d*, of the latter lever; and the screw F, is then screwed up to close the cap C, tightly. The next thing to be done is to expel the air from the gun, which is done by opening the stop-cock in the pipe *f*, and admitting steam slowly from the boiler by the pipe G, till it issues copiously from the air escape-pipe *f*, when the latter may be closed entirely, and steam admitted freely by the steam-pipe. The temperature in the boiler should be about 390° Fahr., which will give a pressure of above two hundred pounds per square inch. After steam has been admitted to the gun for a few minutes, the temperature of all the water that remains in the wood, not displaced by the steam or converted into steam, will be the same as that in the boiler; and a quantity of water that will have been collected in the lowest part of the gun, by reason of the condensation of the steam

in contact with the interior surface of the gun, and by the expulsion from the wood, will be of the same temperature also. The cap may then be set free, by an attendant, standing some distance behind the muzzle, tripping up the prop piece *d*, by pulling a string *h*, attached thereto, and depressing the rear end of the lever E. The hook *b*, will thus be raised from the lever D, and the pressure of the confined steam will force off the cap C. The steam, which is instantly generated from the water in the rear portion of the gun, by the reduction of the pressure, will force the wood out of the gun, and as it emerges, the expansion of the steam in and among its tubes, and the instantaneous flashing into steam of a portion of water remaining in it, will effect a perfect separation of its fibres, leaving them in a state in which they may either at once, or after bleaching, be introduced to the pulp-mill or other machinery for their reduction into pulp, or into a suitable state for conversion into paper. The fibres, it may be stated, though scattered about, are nearly all left within seventy or eighty feet from the muzzle of the gun, and may be collected without difficulty.

The patentee claims, "separating the fibres of wood and other fibrous substance by charging the same with steam, air, or other gaseous body or hot water, in a cylinder or other suitable receptacle substantially similar to that herein described, and afterwards suddenly subjecting the substance under operation to a sufficiently diminished atmospheric pressure, to cause its disruption, by the expansion of the fluid or gaseous body within it."

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*On a New Method of Manufacturing Ammonia.**

By ALEXANDER WILLIAMS, Neath.

The importance of ammonia and its sister compound, nitric acid, in an agricultural point of view, as forming probably the chief sources whence the nitrogen of plants is obtained, and the high commercial price of compounds containing either of these substances, have led practical chemists to look upon any new method of obtaining them as one of the great desiderata of the day.

The atmosphere, with its water, contains the elements necessary for the formation both of ammonia and nitric acid, and during the passage of electricity both are formed; but so far as our present knowledge extends, and from a long series of experiments on the subject, I am led to believe that it will be some time ere the Society's premium will be claimed "for the production of ammonia or nitric acid *from their elements*, by methods which would admit of practical application."

After having been engaged for many years in experiments on this subject, I have arrived at the conclusion that, except under peculiar circumstances, nitrogen and hydrogen in their gaseous or elementary state, will not combine together in sufficient quantities to be commercially available. To make them unite in any quantity it is necessary that the nitrogen should, in its nascent state, be brought in contact

* From the Journal of the Society of Arts, No. 339.

with the hydrogen, when union will take place, but this combination is much more readily effected if both be in their nascent state.

To obtain nascent nitrogen it is, of course, necessary to decompose one of its compounds, and thus far I had only arrived at the same conclusion as every one else. The object of this paper is to direct attention to a bye-product of one of our most important chemical manufactories, which is exactly adapted for our purpose.

The animal and vegetable kingdoms have been so thoroughly searched by the shoals of manure manufacturers of this and other countries, that the discovery of any new nitrogen compound in these kingdoms seems to be altogether improbable; one is therefore naturally led to the mineral kingdom, and our ideas as naturally become fixed on nitrate of soda as the cheapest source. It has been known for years that nitric acid, or other compounds of nitrogen and oxygen, could be converted into ammonia, and therefore the use of a nitrate would present no novelty; but if we can obtain the nascent nitrogen from nitrate of soda as a bye-product, we shall have made a grand step towards facilitating the manufacture of ammonia.

This, I believe, I have accomplished. Of the thousands of tons of nitrate of soda annually imported into this country, I have been told, on good authority, that about half is used in the manufacture of sulphuric acid. It is well known that sulphuric acid is usually manufactured in a large leaden chamber having attached to it a burner where sulphur is kept constantly burning, by which it is converted into sulphurous acid. The great difficulty of the manufacture is to give another atom of oxygen to this sulphurous acid ($S\ O_2$) to convert it into sulphuric acid ($S\ O_3$), and it is for this purpose that the nitrate of soda (cubic nitre) is used, and usually in the following manner: —one or more movable iron pots are placed in the burner. Into each of these pots is put, as often as required, a few pounds of nitrate of soda, and with it a sufficient quantity of sulphuric acid to decompose it. Sulphate of soda (salt cake) remains in the pot, whilst nitric acid and probably other compounds of nitrogen and oxygen pass with the sulphurous acid into the leaden chamber. The sulphurous acid ($S\ O_2$) gains an additional atom of oxygen from the nitrogen compounds, and becomes converted into sulphuric acid ($S\ O_3$) which, with water afforded by steam jet or otherwise, condenses as a liquid at the bottom of the chamber, whilst a quantity of gas escapes.

Such is a rough sketch of the first part of the process usually adopted for making sulphuric acid or oil of vitriol, and the gas which escapes from the vitriol chamber must now be the subject of our inquiry.

On referring to Dr. Ure, our great authority on manufacturing chemistry, I found that he asserts that in a properly working chamber nothing but nitrogen gas should escape; in fact, that the whole of the oxygen should be taken up, and that the nitrogen should be reduced to its elementary condition. This, although the generally received opinion of the manufacturing chemists of the present day, appeared to me fallacious; as, on considering the affinities, I did not think it

probable that sulphurous acid, although it is known to form a compound with nitric oxide ($N\ O_2$), should, under the circumstances occurring in the vitriol chambers, be able to decompose it. Experiments were immediately instituted to ascertain the truth, and they led to the knowledge of the fact that a chemical compound of nitrogen and oxygen was escaping, and not free nitrogen. What particular compound of nitrogen and oxygen it is has not been ascertained, as the fact of its being a *chemical* compound was sufficient for the purpose intended, viz: of applying this waste product for the manufacture of ammonia.

At the commencement of the year 1856, I transferred a portion of the gases escaping from a vitriol chamber to my own laboratory, and there and then succeeded in converting them into ammonia.

This was an important step, but I did not feel satisfied until I had tried the process on the large scale; therefore, in November in the same year, an arrangement was entered into for this purpose with Messrs. Lewis and Pollard, of the Pontardawe Vitriol Works, whose kind assistance in the matter I take this opportunity of acknowledging.

The apparatus fitted up was of the following description:—A furnace was built above the exit tube of one of their vitriol chambers, and a brick gas retort, about 14 inches in diameter, 8 feet long, and open at both ends, was passed through its whole length. This retort was filled with charcoal, and kept at a red heat; the exit tube of the chamber, and a steam jet to supply the hydrogen, were attached to one end, whilst to the other end was fixed an upright leaden cylinder filled with coke, and moistened with diluted sulphuric acid. On passing the waste gases and steam through the retort containing red hot charcoal, both were decomposed, the oxygen of each uniting with the charcoal to form carbonic acid ($C\ O_2$); the nitrogen and hydrogen combining to form ammonia ($N\ H_4\ O$, or, without water, $N\ H_3$); then together, probably forming carbonate of ammonia ($N\ H_4\ O_1\ \ C\ O_2$), which was again decomposed by the diluted sulphuric acid, the sulphate of ammonia being found remaining in solution. This solution was then evaporated, and in July, 1857, I first had the pleasure of obtaining any quantity of crystals of sulphate of ammonia, by this process, from a vitriol chamber in actual work.

It was the intention at that time to have secured the invention by patent, and therefore, when the above comparatively rough result had been obtained, the further prosecution of the experiments to ascertain yield, &c., was not proceeded with, lest the process should become public. Several circumstances have since prevented their renewal. I therefore merely wish to offer the process as it is to those interested in the matter, hoping some one else may apply it more profitably than I have, and feeling sure that—as there seems no reason why it should not be successfully carried out—it will be the means of advancing the "arts, manufactures, and commerce" of this country, by increasing the supply of one of our most valuable fertilizers.

Perhaps it may be thought that the process is only adapted to such gases as escape directly from the chamber, and that, if any of the late

improvements as coke cylinders, &c., be used it cannot be applied; but provided the assertion be correct that sulphurous acid is incapable of reducing compounds of nitrogen and oxygen to their elementary state, then the process will be available after all these improvements have been carried out, and not only to the waste gases, but also, by a slight modification, to any nitrogen compounds that may have been absorbed by the dilute sulphuric acid, and be given off in its evaporation, so that really a very minute portion only of the nitrogen contained in the nitrate of soda need be lost.

With regard to the quantity obtainable by these means. I have not as yet been able to ascertain with certainty the amount of nitrate of soda imported, but, as already stated, it appears probable that about half of the whole quantity arriving in this country is used in the manufacture of oil of vitriol, or sulphuric acid. Now, every thousand tons of this cubic nitre, allowing 10 per cent. for impurities, would, if the whole of its nitrogen were converted into chloride of ammonia ($N\,H_4\,O$), yield about 565 tons of this substance, which, at £30 per ton, would be worth nearly £17,000, and there are, doubtless, many thousands of tons of nitrate of soda used by the vitriol makers of this country.

Although these figures give, of course, no approximation to the practical yield likely to be afforded by this process, yet they enable us to form a very good idea of the enormous amount of valuable material daily wasted. The process suggested, or some modification of it, may render this waste unnecessary, and thus save the pocket of the manufacturer, and, at the same time, benefit the public.

A new form of Barometer. By M. de Celles.

This consists of two tubes united at right angles. The vertical branch being closed and the instrument filled as usual. The horizontal tube takes the place of the cistern, and a very slight diminution in the vertical column produces a great change in the length of the horizontal one—which is of much less diameter than the other. A steel index in front of the horizontal column will serve to register.

Acad. Sciences of Paris.

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*Water in Lighthouses.**

Prof. Faraday writes to the *Times*, giving some useful information as to the purification of water contaminated with chloride of lead from salt spray resting on the leads of lighthouses, &c., whence rain-water is collected. The water thus contaminated is peculiar in this, that it does not lose the poisoning substance either by boiling or by exposure to air. The process of purification is exceedingly simple, for if some powdered chalk or whiting is put into the cistern in which such rain-water is collected, and stirred up occasionally after rain, the water may, with the greatest facility, be obtained in a perfectly fit state for all culinary and domestic purposes. The Trinity-house has supplied this information to all the cases needing it which have come to its knowledge.

* From the Lond. Builder, No. 870.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, November 17, 1859.

John Agnew, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Statistical Society, London; the Catholic University of Ireland, Dublin; the K. K. Geologischen Reichsanstalt, and the K. K. Geographischen Gesellschaft, Vienna, Austria; L. A. Huguet-Latour, Esq., Montreal, Canada; the Providence Athenæum, Providence, Rhode Island; and Prof. J. Aitkens Meigs, Philadelphia, Pa.

Donation to the Cabinet of Models and Minerals from Prof. John C. Cresson, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of November, was read.

The Board of Managers and Standing Committees reported their minutes.

Thirty-three resignations of membership in the Imstitute were read and accepted.

Candidates for membership in the Institute (17) were proposed, and the candidates proposed at the last meeting (17) were duly elected.

George M. Alsop exhibited an atmospheric spring for railroad cars, invented by him.

The principle on which this spring was constructed, was the application of a suitable fluid to surround a hermetically sealed air ball of rubber, inclosed in a water-tight chamber or vessel, having a flexible cover or diaphragm of rubber and leather, the latter being moulded so as to allow of considerable motion without being strained. The object of making use of a fluid to surround the air vessel, was stated to be to remedy the defect in the construction of all other air springs, viz: the gradual escape of the air, which the inventor thought would be accomplished by his arrangement, as the fluid would form the medium through which the pressure exerted upon the spring would act upon the air in the air vessel; and as the pressure within and outside the ball would always be the same, there would be no tendency in the air to escape.

Mr. Joseph Hoskin exhibited one of his "Sighted Adjustable Spirit Levels." It consists of a brass stock of box shape, planed and scraped truly. One end has a sight hole, and the other a glass affixed, across which the cross, of silk, passes. This sight is intended to do away with the necessity of using straight edges or lines when leveling from one object to another over an intervening space. The tubes are made adjustable by screws, and all of the usual sort; one for horizontal and the other for vertical work. The apparatus is got up with ease, and will, no doubt, exactly suit its intended purpose.

Abstract of Meteorological Observations for September, 1859; made in Philadelphia, Adams, and Somerset Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

1859. Sept.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Force of vapor. 2 P.M.	Relative humidity. 2 P.M.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Inch.	Per ct.	Inches.	Direc.
1	29·731	·913	67·5	22¼	1·3	·591	89		S W.
2	29·724	·981	67·8	16¼	2·0	·255	29		W.
☽ 3	29·820	·117	68·7	27	5·2	·351	36	0·175	S W.
4	29 841	·075	72·3	15	5·3	·614	68		W.
5	30·035	·194	69·8	13	11·5	·412	77	0·175	N N E.
6	30·977	·041	63·8	18	5·3	·326	42		N W.
7	30·116	·046	64·0	22	2 2	·376	46		N W.
8	39·142	·026	65·2	23	1·5	·299	36		N N W.
9	30·120	·022	66·0	24	1·2	·428	51		S W.
10	30·044	·076	70·5	22	4·5	·464	47		S S W.
11	29·714	·330	73·3	17	2·8	·592	60		S W.
○ 12	29·523	·224	72·3	17¼	1·7	·347	34		W.
13	29·462	·064	69·0	24	3·3	·450	44		(var.)
14	29·787	·324	60·0	24	9·0	·265	31		N W.
15	30·999	·313	56·5	19¼	3·5	·215	35		(var.)
16	30·035	·965	57·8	10	4·7	·420	82	9·900	E.
17	29·506	·529	60·3	9	3·2	·473	88	3·292	N E.
18	29·759	·253	64·2	20	6·5	·468	62		N W.
☾ 19	29·753	·066	67·7	26	5·2	·549	67		S W.
20	29 728	·037	69·0	14	0·7	·658	90	0·822	S W.
21	29·767	·039	66·0	13	5·0	·612	89	1·577	N E.
22	29·804	·042	63·2	10	5·8	·549	89	0·818	N E.
23	29·838	·950	69·2	13¼	6·0	·608	80		N W.
24	29·770	·083	69·0	15¼	3·2	·497	54		S W.
25	29·765	·019	67·7	15	1·3	·524	62	0 110	N E.
● 26	29·803	·039	67·2	18½	2 2	·554	64		(var.)
27	29·849	·940	68·8	21	1·7	·587	61		W S W.
28	29·884	·068	72·0	16	3·8	·546	52		W.
29	30·110	·220	64 8	16	7·2	·418	61		(var.)
30	30·131	·953	63·8	22	2·3	·389	50		N E.
Means	29·858	·119	66·2	18	4·1	·462	69	7·779	N 79¼ W.

GETTYSBURG, Adams Co. Lat. 39° 49′ N. Long. 77° 18′ W. Height 624 feet. Prof. M. JACOBS, Obs.

1859. Sept.	Barometer. Mean.	Barometer. Mean daily range.	Thermom. Mean.	Thermom. Mean daily range.	Rain.	Prevail'g. winds
	Inch.	Inch.	°	°	Inch.	Direc.
1	29·367	·004	66·7	0·4		W S W.
2	29·391	·087	64·7	8·0		W.
3	29·433	·094	65·8	10 5	0 010	S W.
4	29·479	·105	69·3	7·8		(var.)
5	29·666	·187	57·7	11·7	9·139	S W.
6	29·778	·112	58·3	6·0		N N E.
7	20·798	·022	59·9	3·3		S.
8	29·804	·012	60·0	2·3		(var.)
9	29·773	·035	63·3	3 3		S W.
10	29·670	·110	71·0	7·7		S S W.
11	29·299	·304	71·7	1·3	9·019	S W.
12	29·152	·147	60·3	2·3		W.
13	29·123	·112	65·7	5·7	9·199	(var.)
14	29·431	·309	60·0	7·0		N W.
15	29·720	·288	55·9	5·0		N.
16	29·651	·065	57·0	6·7	} 3·386	N N E.
17	29·194	·457	58·3	6·3		N N E.
18	29·436	·242	62·7	6·0		(var.)
19	29·320	·116	66·7	9·3		S S W.
20	29·285	·051	68·3	8·7	0·335	S S E.
21	29·313	·028	68·3	5·0	1·650	S.
22	29·419	·106	62·0	7·7	0·716	N N E.
23	29·508	094	66·7	4·7	0·005	N N E.
24	29·522	·072	63·7	3·3		N W.
25	29·526	·053	63·0	2·3		N.
26	29·491	·039	63·0	2·0		(var.)
27	29·481	·042	64·7	1·7		S.
28	29·548	·067	67·7	3·7		(var.)
29	29·767	·209	62·0	5·7		(var.)
30	29·775	·012	64·0	2·0		S E.
Means	29·503	·122	63·5	5·2	6·342	S 84° W.

SOMERSET, Somerset Co. Lat. 40° N. Long. 79° 3′ W. Height 2105 feet. GEO. MOWAY, Observer.

1859. Sept.	Barometer. Mean.	Barometer. Mean daily range.	Thermom. Mean.	Thermom. Mean daily range.	Force of vapor. 2 P.M.	Relative humidity. 2 P.M.	Rain.	Prevail'g winds
	Inch.	Inch.	°	°	Inch.	Per ct.	Inch.	Direc.
1	27·594	·903	60·0	1·0	·416	52		W.
2	27·617	·066	56·0	6·7	·375	59		W.
3	27·640	·060	61·7	9·7	·498	55	0·120	S W.
4	27·709	·087	61·7	7·3	·416	57		W N W.
5	27·817	·108	60·0	2·3	391	54		(var.)
6	27·917	·100	65·0	5 0	·300	48		N N E.
7	27·896	·022	57·3	3·0	·411	60		(var.)
8	27·004	·109	58·0	6·0	·435	57		E.
9	27·910	·113	64·3	6·3	·549	57		W.
10	27 828	·087	66·0	4·3	·574	69		W S W.
11	27·552	·272	67·3	2·7	·654	81	9·635	W.
12	27·435	·117	63·0	4·3	422	54		W.
13	27·388	·084	54·3	8·7	·452	94	9·057	(var.)
14	27·641	·253	51·7	5·3	·311	56		W N W.
15	27·830	·189	54·3	2·7	·355	62		S E.
16	27·721	·110	54 0	5·7	·390	93	} 2·218	S E.
17	27·519	201	56·0	2 0	·452	94		(var.)
18	27·641	·122	62·0	6·7	·554	64		N W.
19	27·511	·131	66·3	4·3	·676	66	9·252	S W.
20	27·457	·040	65·0	8·0	·564	89	0·172	S S E.
21	27·458	·005	66·7	1·7	·608	80	0·062	S E.
22	27·585	·127	67·9	3·7	·563	61		W.
23	27 696	·107	61·7	5·3	·469	67	9·025	W.
24	27·650	·046	56 3	5·3	·439	88	0·304	W.
25	27 626	·029	59·7	4·0	·443	65		(var.)
26	27·654	·028	60·3	2·7	·523	67	9·009	(var.)
27	27·646	·008	61·7	4·0	·577	84	9·243	S W.
28	27·766	·120	60·0	6·3	·500	74		N W.
29	27·856	·090	59·0	4·3	·469	67		S S E.
30	27·853	·021	58·3	4·0	·429	77		S E.
Means	27·677	·088	60·1	4·8	·474	68	4·678	S 63½ W.

Abstract of Meteorological Observations for September, 1859; made in Dauphin, Huntingdon, Centre, and Allegheny Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

Harrisburg, Dauphin Co. 40° 16′, N. 76° 15′, W. Height. 300 feet. John Heisely, M. D., Observer.

1859. Sept.	Barometer. Mean.	Barometer. Mean daily r'nge.	Ther. Mean	Ther. Mean daily range.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	Inch.	Direc.
1	29·637	·007	69·3	0·6		S W.
2	29·652	·089	68·0	5·3		N W.
☽ 3	29·691	·093	70·0	8·0		S E.
4	29·762	·111	72·7	6·0		W.
5	29·958	·199	63·0	9·7		S E.
6	30·051	·093	63·7	2·0		N W.
7	30·047	·023	63·0	2·0		S.
8	30·065	·018	63·7	0·7		N.
9	30·051	·014	68·0	4·3		N.
10	29·919	·132	74·7	6·7		S E.
11	29·580	·339	74·7	3·3	0·072	S W.
○ 12	29·409	·171	73·3	2·7		N W.
13						?
14	29·695		62·3			N W.
15	30·058	·364	56·3	6·0		S.
16	29·932	·126	56·0	5·0	5·063 (16–17)	E.
17	29·495	·437	60·3	4·3		(var.)
18	29·698	·203	65·3	4·7		W.
☾ 19	29·609	·092	68·7	7·3		S W.
20	29·577	·049	71·7	7·7	3·83 (20–22)	S.
21	29·609	·032	70·3	4·0		E.
22	29·701	·092	62·0	9·7		(var.)
23	29·755	·054	68·7	6·7		(var.)
24	29·719	·059	68·3	0·3		(var.)
25	29·692	·040	67·3	1·0		W.
● 26	29·7[illegible]8	·046	68·0	1·3		W.
27	29·7[illegible]2	·024	68·7	2·0		S.
28	29·811	·095	70·7	4·0		W.
29	30·0[illegible]7	·216	64·3	6·3		W.
30	30·0[illegible]3	·052	65·3	3·0		S E.
Means	29·783	·117	66·8	4·5	8·965	s 81° w

Huntingdon, Huntingdon Co. Lat. 40° 35′ N. Long. 78° 3′ W. Height, 734 feet. W. Brewster, M. D., Observer.

Sept.	Barometer. Mean.	Barometer. Mean daily range.	Ther. Mean.	Ther. Mean daily range.	Force of vapor. 2. P. M.	Relative humidity. 2 P. M.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	Inch.	Per ct.	Inch.	Direc.
1	29·232		61·7		·540	60		(var.)
2	29·248	·074	62·3	8·7	·408	41		W.
3	29·272	·081	63·0	12·7	·319	40		(var.)
4	29·340	·109	65·7	9·3	·349	40		(var.)
5	29·507	·166	58·7	8·3	·313	52		(var.)
6	29·613	·107	57·3	5·3	·231	34		(var.)
7	29·595	·019	55·3	2·7	·348	51		N E.
8	29·620	·023	56·7	1·3	·384	52		S.
9	29·576	·040	62·3	5·7	·435	48		S E.
10	29·462	·114	69·3	7·0	·522	51	0·018	(var.)
11	29·173	·289	69·0	5·0	·667	85	0·197	S E.
12	29·034	·139	65·7	6·7	·421	45		S E.
13	29·010	·121	62·0	7·7	·475	69		W.
14	29·297	·287	58·3	3·7	·244	37		W.
15	29·581	·284	51·0	7·3	·255	46		S E.
16	29·466	·115	56·0	7·7	·375	93	3·170 (16–17)	N E.
17	29·155	·311	57·7	5·0	·452	94		N.
18	29·283	·128	60·7	5·7	·366	52		N W.
19	29·162	·121	68·7	8·7	·573	58		S E.
20	29·117	·057	67·7	6·3	·631	80		var.
21	29·158	·021	66·7	3·0	·665	77	0·280	(var.)
22	29·240	·102	64·7	4·7	·594	76		(var.
23	29·303	·064	66·3	3·0	·469	52		(var.
24	29·302	·031	60·7	5·7	·516	84	0·041	S E
25	29·272	·030	63·0	3·0	·608	80		var.
26	29·295	·023	61·7	4·7	·469	52		var.
27	29·285	·012	66·0	4·3	·536	54	0·055	var.
28	29·385	·101	65·3	4·0	·567	68		W.
29	29·564	·178	58·3	7·0	·448	61		S E.
30	29·554	·039	60·7	5·7	·451	73		(var).
Means	29·336	·110	62·1	5·9	·459	60	3·761	s. 54° e.

Fleming, Centre Co. 40° 55′ N. 77° 53′ W. Height, 780 feet. S. Brugger. Obs. — **Tarentum, Allegheny Co.** 40° 37′ N. 79° 46′ W. Height 950 feet. J. H. Baird, Obs.

Sept.	Fleming Thermom. Mean.	Fleming Thermom. Mean daily range.	Fleming Rain.	Fleming Prevailing winds.	Tarentum Thermometer. Mean.	Tarentum Thermometer. Mean daily range.	Tarentum Prevailing winds.
	°	°	Inch.	Direc.	°	°	Direc.
1	59·3	3·7		N W.	61·7		S W.
2	58·0	8·0		N W.	58·3	10·0	W.
3	67·7	12·3		S W.	64·0	13·0	S W.
4	62·3	11·3		N W.	60·0	10·7	W.
5	56·3	10·0		W.	55·7	4·3	(var.)
6	55·3	7·0		(var.)	52·7	5·0	N.
7	55·7	1·0		N W.	55·3	2·7	N W.
8	57·3	5·0		(var.)	55·7	2·3	(var.)
9	62·3	5·0		N W.	63·0	7·3	S.
10	70·0	7·7	0·160	W.	69·7	8·0	S W.
11	69·7	3·7	0·162	N W.	71·3	3·7	S W.
12	62·7	7·0		N W.	64·7	6·7	S W.
13	61·3	4·7		N W.	63·0	6·3	(var.)
14	54·0	7·3	0·020	(var.)	53·7	9·3	W.
15	49·3	4·7		S W.	57·7	4·7	N E.
16	52·0	8·0	3·180 (16–17)	E.	57·0	5·3	S.
17	59·0	7·0		N W.	59·0	2·0	W.
18	61·3	7·0		(var.)	57·3	4·3	W.
19	62·3	6·3		(var.)	65·7	11·0	S W.
20	70·7	7·0	0·100	(var.)	68·0	7·7	(var.)
21	68·7	2·0	0·775	S E.	70·7	2·7	(var.)
22	66·3	3·0	0·175	E.	66·3	4·3	S.
23	65·3	3·0		(var.)	60·7	5·7	S.
24	64·7	3·3		(var.)	60·0	2·0	S W.
25	64·0	2·0	0·113	(var.)	62·3	2·3	?
26	64·3	3·0		(var.)	60·3	2·7	S W.
27	65·3	3·0	0·170	S W.	63·0	4·7	?
28	67·3	7·3		S W.	58·7	6·3	W.
29	57·7	9·7		(var.)	58·7	2·7	N E.
30	61·0	5·3		(var.)	63·7	5·0	(var.)
Means	61·7	5·8	4·855	west.	61·3	5·4	s. 61° w.

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